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FINAL

FLOOD CONTROL
BURLINGTON DAM

SOURIS RIVER, NORTH DAKOTA

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REPORT DOCUMENTATION PAGE

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4. TITLE (and Subtitle) FLOOD CONTROL, BURLINGTON DAM, SOURIS RIVER, NORTH DAKOTA, Final Environmental Impact Statement.		5. TYPE OF REPORT & PERIOD COVERED Final EIS
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9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Paul 1135 U.S. Post Office and Custom House St. Paul, MN 55101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

See also Draft supplement, December 1979; Draft EIS, October 1977.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Flood control
Environmental impact statements
Burlington Dam
Souris River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The proposed plan includes a dam near Burlington, North Dakota, on the Souris River; a raise of Lake Darling Dam; a diversion tunnel to carry flood flows on the Des Lacs River to the Souris River above Burlington Dam; and downstream channel works consisting of levee improvements in developed subdivision areas between Burlington and Minot, North Dakota; channel modifications through and below Minot and levee improvements at the communities of Sawyer, North Dakota, and Velva, North Dakota. This would provide protection for occupants of the

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Minot area floodplain and of the Souris River floodplain downstream from Minot. Upstream from the reservoir and above Lake Darling Dam, terrestrial vegetation, such as grasslands, wetlands, and bottomland hardwoods would be significantly affected by periods of flood water storage.

ENVIRONMENTAL IMPACT STATEMENT

FLOOD CONTROL

BURLINGTON DAM

SOURIS RIVER, NORTH DAKOTA

U.S. DEPARTMENT OF THE ARMY
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101
January 1978

FOREWORD

A study of flood problems on the Souris River was authorized by resolutions of the Senate and House Public Works Committees adopted on 28 March 1949 and 29 July 1955, respectively. A survey study was initiated in 1963 to formulate a flood damage reduction plan. All practical plans were compared and evaluated, including flood warning and emergency measures, flood insurance, flood proofing, floodplain regulation, floodplain evacuation, channel improvements, levees and floodwalls, Souris River diversion channels, Souris and Des Lacs River dams and storage impoundments, and Des Lacs River diversion tunnels. The survey report, completed in 1969, recommended construction of a dam and reservoir on the Souris River near Burlington and modification of the Souris River channel at, through, and below Minot. The channel modification was authorized by the Senate and House Public Works Committees on 25 June and 14 July 1970, respectively. The reservoir was authorized by the Flood Control Act approved 31 December 1970.

In compliance with the requirements of the National Environmental Policy Act of 1969, a draft revised environmental impact statement (EIS) was furnished to the public in February 1974. A final updated EIS was presented to the public in January 1975. However, because of extensive modifications to the proposed project, it was deemed necessary to reconsider the environmental, economic, and social impacts associated with the project. A draft EIS addressing these impacts was completed in October 1977 and circulated to Federal, State and local agencies and interested groups and individuals for their comments. This draft EIS was filed with the President's Council on Environmental Quality in November 1977.

After receipt and consideration of comments on the draft EIS, the Corps prepared this final EIS, which includes responses to the questions and objections raised by the comments, and a final analysis of the project's environmental effects and the alternatives available. When this final statement is filed with the United States Environmental Protection Agency, a 30-day review period will ensue. During this period, all interests are invited to review the statement and submit written comments.

The public should be aware that the proposed plan is still subject to further refinements. Because of the changes in water resource management policy since authorization of Burlington Dam in 1970 and the need to accommodate suggestions by other concerned agencies and local interests, the selected plan described in this document includes several features which depart from the authorized project. As a result some of the changes, such as:

(1) the proposed Des Lacs Diversion unit;

(2) levees to protect residential areas from the 5,000-cfs reservoir maximum release rate;

(3) lands and other elements for environmental mitigation; and

(4) possible compensation for adverse effects in Canada;

may require supplemental authorization by Congress. The document assumes that, if the departures are found to be significant post-authorization changes, congressional authorization will be forthcoming. If congressional authorization is necessary, it could take over a year before Congress decides. In the meantime, our studies and design work on the selected plan will continue.

Coordination in planning with all known interests is a continuing process, and attempts to maintain this coordination are being made. (See section 9 for more detailed information.) Single copies of this statement are available at the Corps of Engineers, St. Paul District Office, 1135 U.S. Post Office and Custom House, St. Paul, Minnesota 55101.

SUMMARY
FINAL
ENVIRONMENTAL IMPACT STATEMENT
FLOOD CONTROL
BURLINGTON DAM
SOURIS RIVER, NORTH DAKOTA

( ) Draft (X) Final Environmental Statement

Responsible Office: U.S. Army Engineer District, St. Paul
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of the Proposed Action: The proposed plan for flood damage reduction on the Souris River includes a dam near Burlington, North Dakota, on the Souris River; a raise of Lake Darling Dam; a diversion tunnel to carry flood flows on the Des Lacs River to the Souris River above Burlington Dam; and downstream channel works consisting of levee improvements in developed subdivision areas between Burlington and Minot, North Dakota, channel modifications through and below Minot[1] and levee improvements at the communities of Sawyer, North Dakota, and Velva, North Dakota. The plan also includes raising the McKinney Cemetery headstones and fence in place, acquiring and removing damageable property in Renville County Park, various forms of flood protection of dwellings in rural areas downstream, modifications to water control structures in the Upper Souris and the J. Clark Salyer National Wildlife Refuges, and acquisition in fee title and management of suitable lands to compensate for adverse effects to wildlife habitat caused by the reservoir. The purpose of the proposed plan is to provide protection for floodplain residents, in particular at Minot and adjacent suburban areas, from floods originating from the Souris River, the Des Lacs River, and local coulees upstream from Minot. There are no provisions for a permanent conservation pool behind the dam. The reservoir would be used only for the temporary impoundment of floodwater when flows in excess of 5,000 cfs threaten Minot. The diversion tunnel would protect Minot against infrequently occurring Des Lacs River floods, and the downstream channel works would protect Minot from the local uncontrolled drainage area and would also serve to facilitate operation and drawdown of the reservoir.

3.a. Environmental Impacts: The plan would provide protection from flooding for occupants of the Minot area floodplain and of the Souris River floodplain downstream from Minot, including the communities of Sawyer and Velva. In addition to providing flood control benefits, construction of the proposed reservoir plan would alleviate unemployment

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(1) Authorized separately in accordance with the provisions of section 201 of the 1965 Flood Control Act.

by recruiting construction workers from the pool of available but unemployed manpower to build the dam and related structures.

b. Adverse Environmental Impacts: The most significant adverse environmental impacts would occur upstream from the reservoir and above Lake Darling Dam. Terrestrial vegetation, such as grasslands, wetlands, and bottomland hardwoods would be significantly affected by periods of flood water storage. Habitat which is important to deer, small mammals, and birds would be adversely impacted. Approximately 30 ranchers and other rural residents would have to be relocated out of the reservoir area. In addition, required fee title purchases include 75 summer homes and cottages in Renville County Memorial Park. There is a possibility that 117 homes and 1,800 acres of agricultural land downstream of the reservoir could be inundated by increased summer flows. Recreation, including fishing, and valley aesthetics would be adversely affected during and following periods of floodwater storage. In addition, waterfowl production on man-made marsh impoundments below Lake Darling Dam would be reduced during years requiring floodwater storage and for some 2 to 5 years afterwards. In accordance with recommendations made by the U.S. Fish and Wildlife Service, the proposed plan includes several mitigatory measures to compensate for the anticipated loss of wildlife habitat.

4. Alternatives:

- Nonstructural
  - No Action
    - Floodplain Regulation and Insurance
    - Floodproofing
    - Flood Warning and Forecasting Services and Emergency Protection
  - Floodplain Evacuation

- Structural
  - Boundary Diversion
  - Flood Barriers
  - Minot Tunnel Diversion
  - Lake Darling Dam
  - Burlington Dam
  - Confluence Dam
  - Burlington Dam and Des Lacs Tributary Dams
  - Lake Darling Dam and Des Lacs Diversion
  - Lake Darling Dam and Minot Diversion
  - Burlington Dam, Des Lacs Diversion, and Gassman Coulee Dam
  - Lake Darling Dam and Flood Barriers
  - Environmental Quality Plan
  - National Economic Development Plan

5. Comments Requested: See page   for a list of those furnished a copy of this draft statement.

6. a. Draft statement to CEQ 4 November 1977.
   b. Final statement to EPA ______________.

FINAL
ENVIRONMENTAL IMPACT STATEMENT
FLOOD CONTROL
BURLINGTON DAM
SOURIS RIVER, NORTH DAKOTA

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1.00 PROJECT DESCRIPTION

1.01 The proposed plan for flood damage reduction on the Souris River, North Dakota, is shown on plates 3 and 4. It includes a dam near Burlington on the Souris River, a raise of Lake Darling Dam, a diversion tunnel to carry flood flows on the Des Lacs River to the Souris River above Burlington Dam, levee upgrading between Burlington and Minot and at Sawyer and Velva, raising the McKinney Cemetery headstones and fence in place, acquiring and removing damageable property in Renville County Park (and possibly developing more compatible recreation features at the site later), various forms of flood protection of dwellings in rural areas downstream, modifications to water control structures in the Upper Souris and J. Clark Salyer National Wildlife Refuges; and acquisition in fee title and management of suitable lands to compensate for adverse effects to wildlife habitat caused by the reservoir. The proposed plan for reservoir operations provides for passage of flows up to 5,000 cfs at Minot by regulating the gates on the raised Lake Darling Dam and then by regulating the gates on Burlington Dam when necessary. All floods up to one having a 2-percent chance of occurring in any year (50-year flood) would be regulated with the added storage behind the raised Lake Darling Dam. Burlington Dam would be used only for temporary storage of floods and would not have a permanent conservation pool. Outflow from Burlington Dam would be held at a constant rate not to exceed 5,000 cfs at Minot until either recession of the flood or 15 May when outflow would be decreased to 500 cfs throughout the growing season and fall harvest. Following harvest, outflow would be increased to permit evacuation of the reservoir but would not exceed 700 cfs.

PROJECT AUTHORIZATION

1.02 The project for flood damage reduction on the Souris River, North Dakota, recommended by the Chief of Engineers in House Document No. 321, 91st Congress, 2d session, provides for two major structural measures: channel modification through Minot, North Dakota, and upstream reservoir development. (See plate 1.) The channel modification feature was approved by Senate and House Public Works Committee resolutions adopted 25 June and 14 July 1970, respectively. The reservoir feature was authorized later by the Flood Control Act approved 31 December 1970 (Public Law 91-611). The Minot channel modification was authorized separately to provide limited flood protection for the city at the earliest possible date.

1.03 This environmental statement presents the impacts of Burlington Dam. Construction of the Minot channel modification project is nearing completion. A separate final environmental impact statement covering the Minot channel was filed with the Council on Environmental Quality in November 1974. Thus, this report pertains only to the portion of the authorized plan involving the reservoir and related works beyond the scope of the Minot channel project.

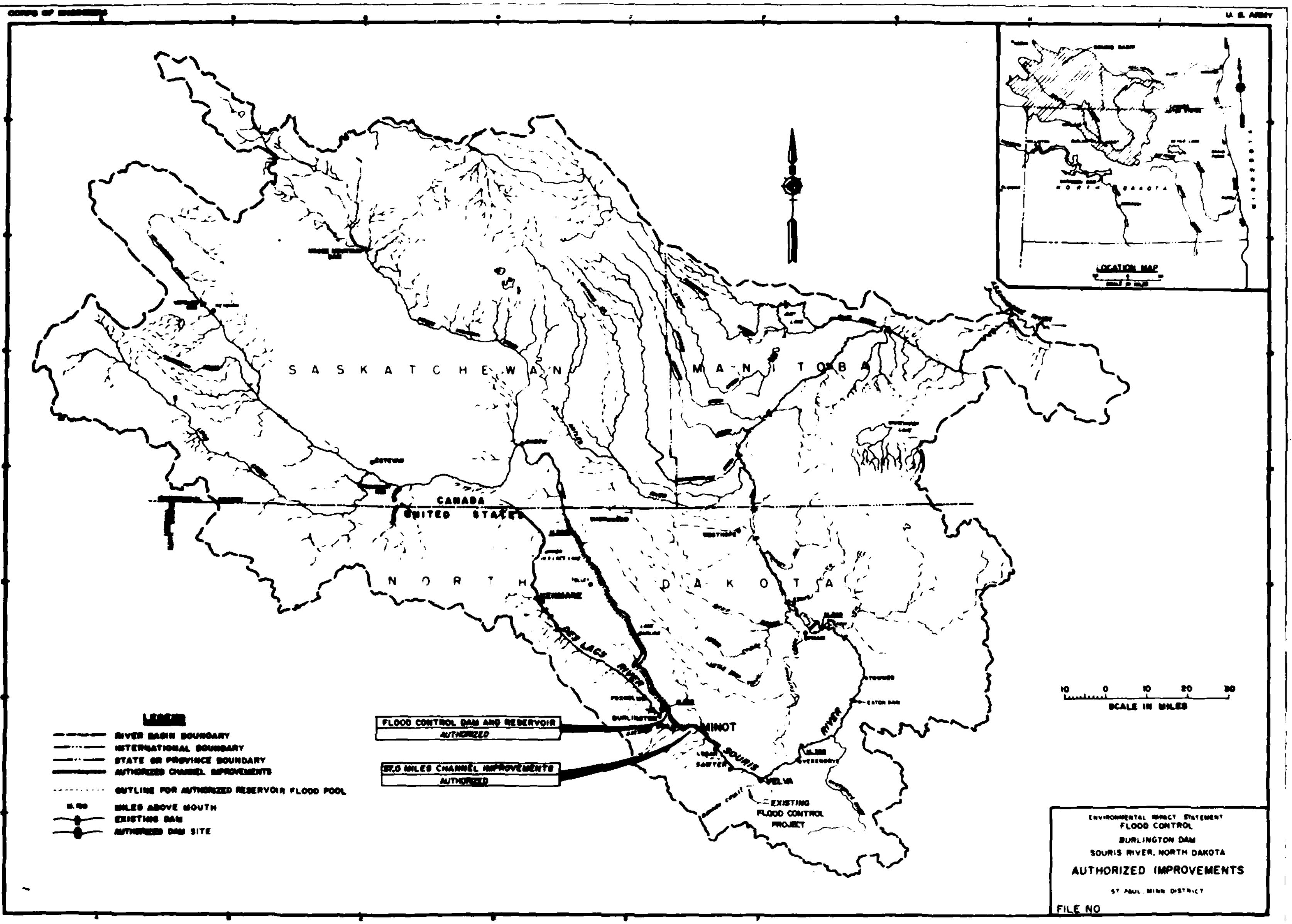
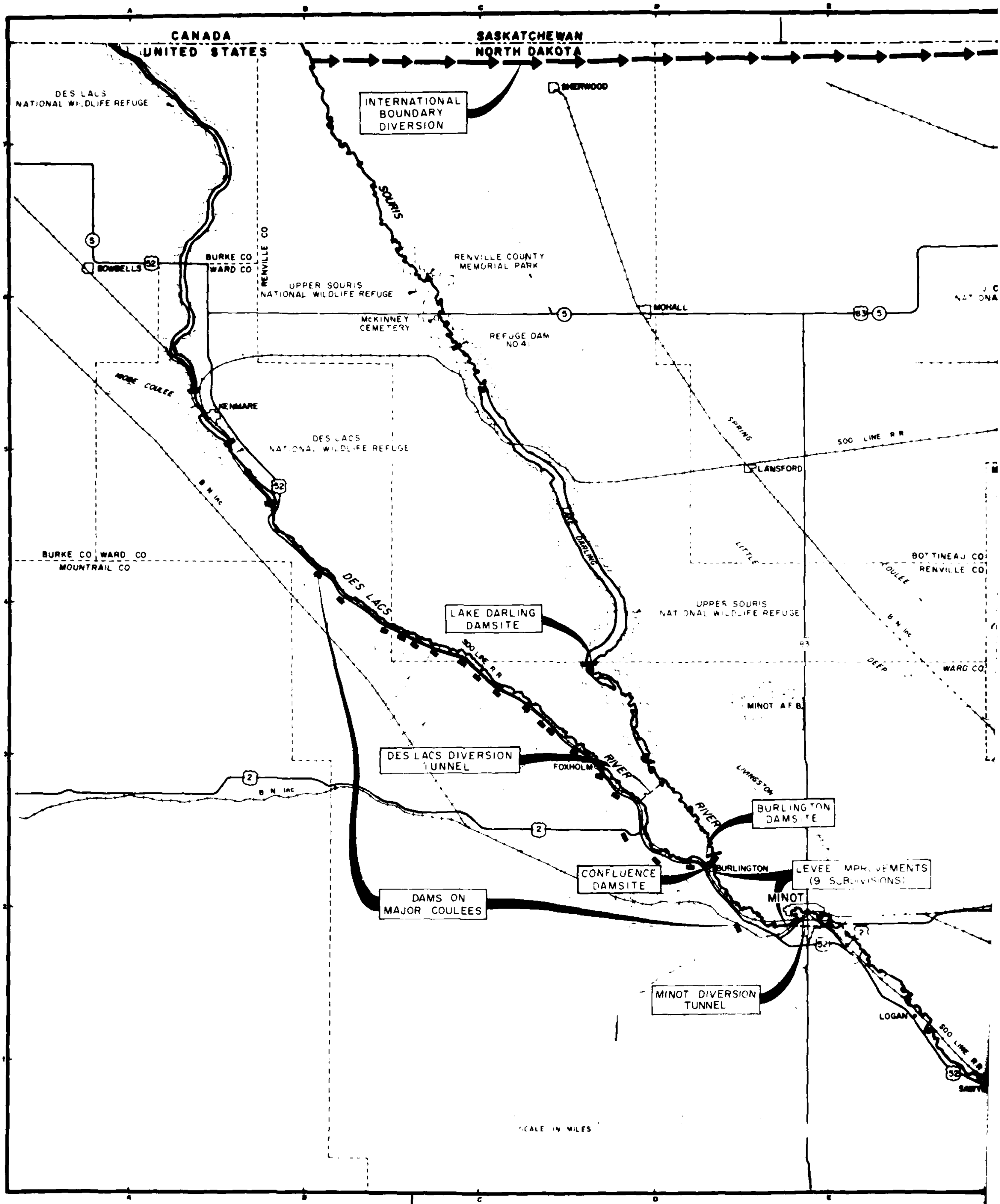
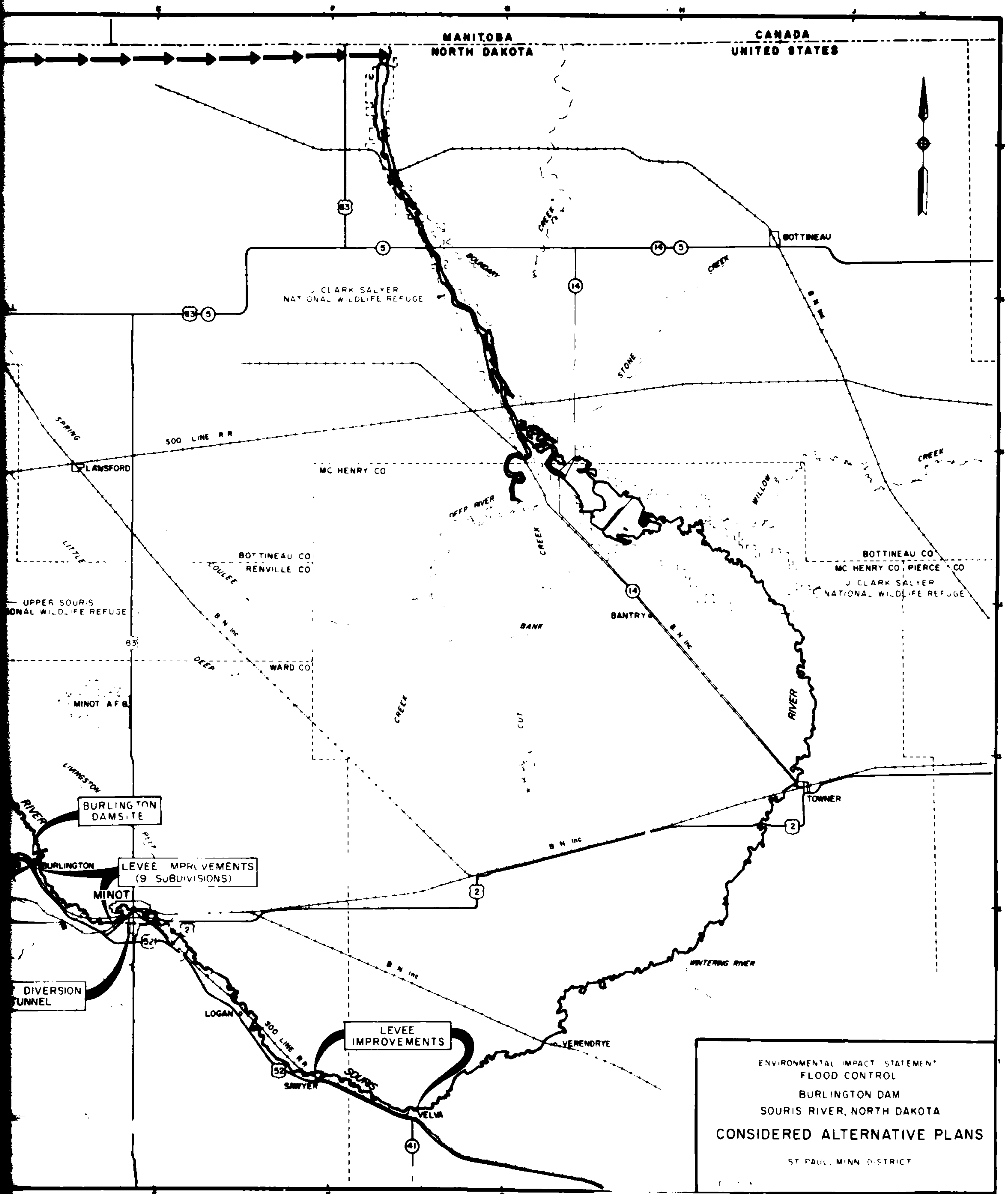

CORPS OF ENGINEERS
U. S. ARMY
SASKATCHEWAN
MANITOBA
CANADA
UNITED STATES
NORTH DAKOTA
DES LACS RIVER
SOURIS RIVER
MINOT
BURLINGTON
SAWYER
VELVA
EXISTING FLOOD CONTROL PROJECT
FLOOD CONTROL DAM AND RESERVOIR
AUTHORIZED
37.0 MILES CHANNEL IMPROVEMENTS
AUTHORIZED
LEGEND
RIVER BASIN BOUNDARY
INTERNATIONAL BOUNDARY
STATE OR PROVINCE BOUNDARY
AUTHORIZED CHANNEL IMPROVEMENTS
OUTLINE FOR AUTHORIZED RESERVOIR FLOOD POOL
MILES ABOVE MOUTH
EXISTING DAM
AUTHORIZED DAM SITE
10 0 10 20 30
SCALE IN MILES
LOCATION MAP
ENVIRONMENTAL IMPACT STATEMENT
FLOOD CONTROL
BURLINGTON DAM
SOURIS RIVER, NORTH DAKOTA
AUTHORIZED IMPROVEMENTS
ST. PAUL, MINN. DISTRICT
FILE NO.

PLATE I



CANADA
UNITED STATES
SASKATCHEWAN
NORTH DAKOTA
INTERNATIONAL BOUNDARY DIVERSION
SHERWOOD
DES LACS NATIONAL WILDLIFE REFUGE
SOURIS
RENVILLE COUNTY MEMORIAL PARK
UPPER SOURIS NATIONAL WILDLIFE REFUGE
BURKE CO
WARD CO
RENVILLE CO
BOWBELLS
MOHALL
McKINNEY CEMETERY
REFUGE DAM NO 41
KENMARE
DES LACS NATIONAL WILDLIFE REFUGE
SPRING
500 LINE R R
LANSFORD
B N Inc
LAKE DARLING
BURKE CO
WARD CO
MOUNTRAIL CO
LITTLE
COULEE
BOTTINEAU CO
RENVILLE CO
DES LACS
LAKE DARLING DAMSITE
UPPER SOURIS NATIONAL WILDLIFE REFUGE
500 LINE R R
DEEP
WARD CO
MINOT A F B
DES LACS DIVERSION TUNNEL
FOXHOLM
RIVER
LIVINGSTON
RIVER
BURLINGTON DAMSITE
B N Inc
CONFLUENCE DAMSITE
BURLINGTON
MINOT
DAMS ON MAJOR COULEES
MINOT DIVERSION TUNNEL
LOGAN
500 LINE R R
SCALE IN MILES



U.S.GPO 1977 765 051/23 Region No.6 PLATE 2

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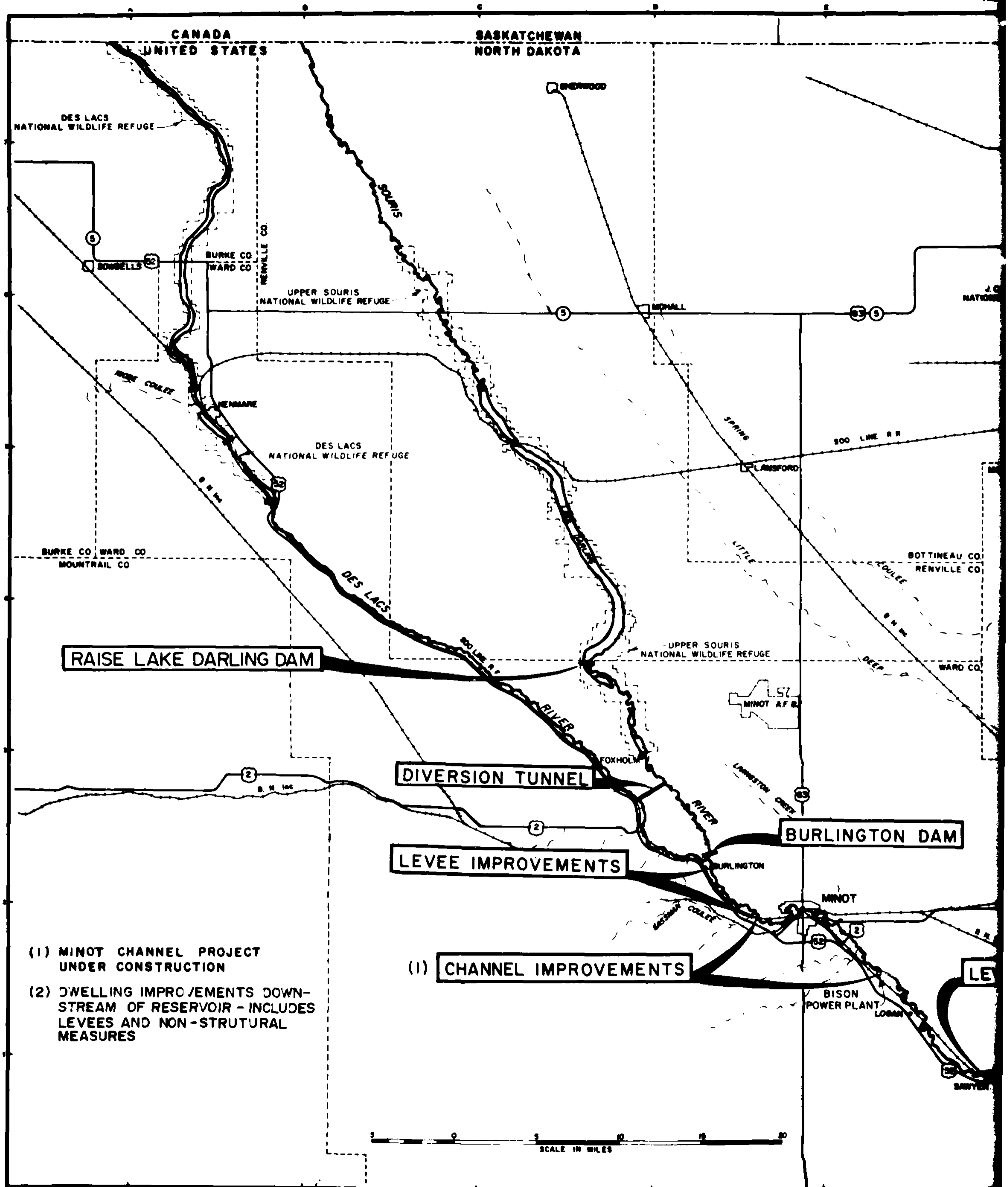
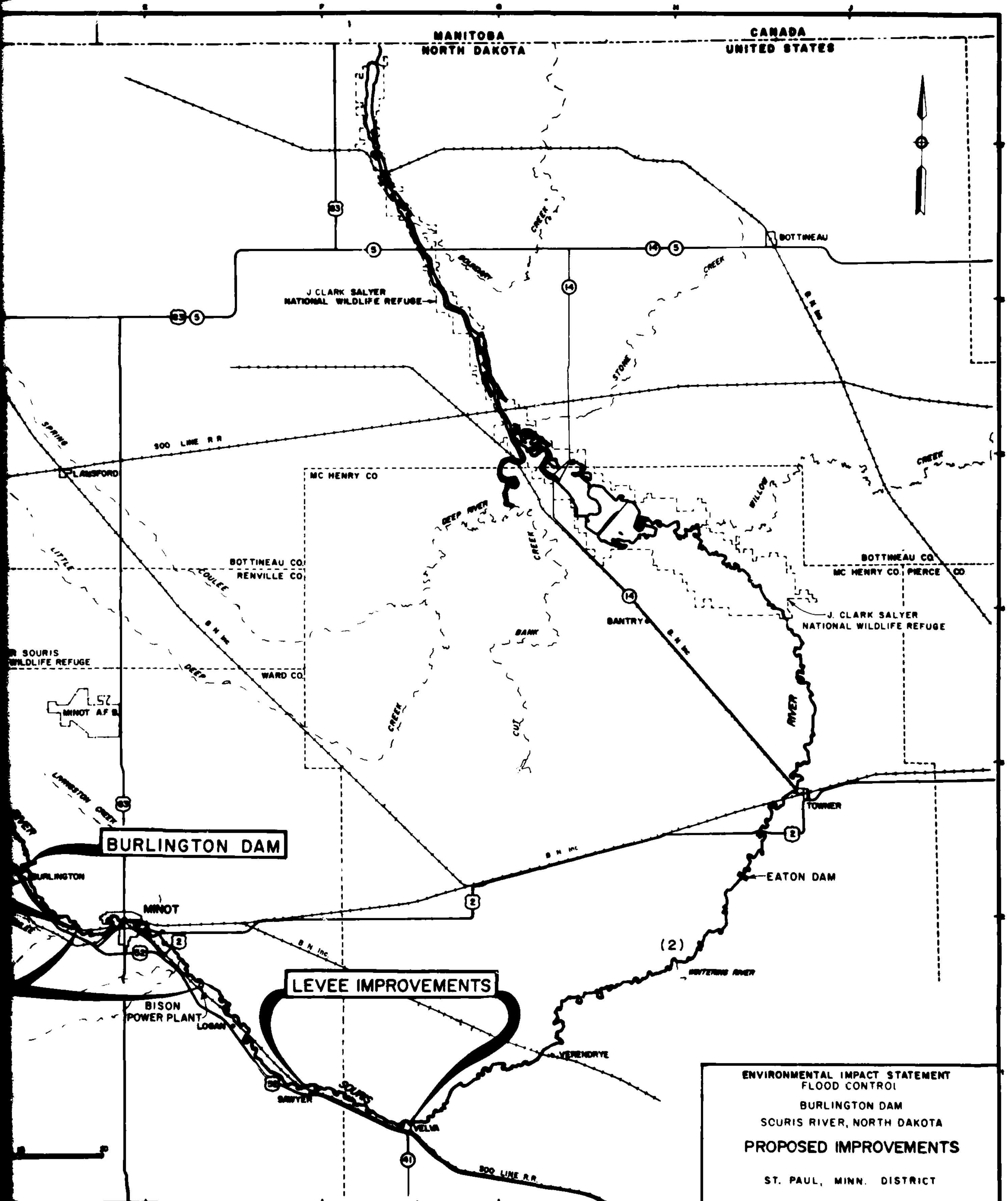


CANADA
UNITED STATES
SASKATCHEWAN
NORTH DAKOTA
SHERWOOD
DES LACS
NATIONAL WILDLIFE REFUGE
SOURIS
BURKE CO
WARD CO
RENVILLE CO
BOWBELLS
UPPER SOURIS
NATIONAL WILDLIFE REFUGE
MOHALL
KENMARE
DES LACS
NATIONAL WILDLIFE REFUGE
SPRING
SOO LINE R R
LANSFORD
BURKE CO WARD CO
MOUNTRAIL CO
BOTTINEAU CO
RENVILLE CO
DES LACS
RAISE LAKE DARLING DAM
UPPER SOURIS
NATIONAL WILDLIFE REFUGE
WARD CO
MINOT A.F.B.
RIVER
FOXHOLM
DIVERSION TUNNEL
RIVER
BURLINGTON DAM
LEVEE IMPROVEMENTS
BURLINGTON
MINOT
(1) MINOT CHANNEL PROJECT UNDER CONSTRUCTION
(2) DWELLING IMPROVEMENTS DOWN-STREAM OF RESERVOIR - INCLUDES LEVEES AND NON-STRUTURAL MEASURES
(1) CHANNEL IMPROVEMENTS
BISON
POWER PLANT
LOGAN
SAWYER
SCALE IN MILES

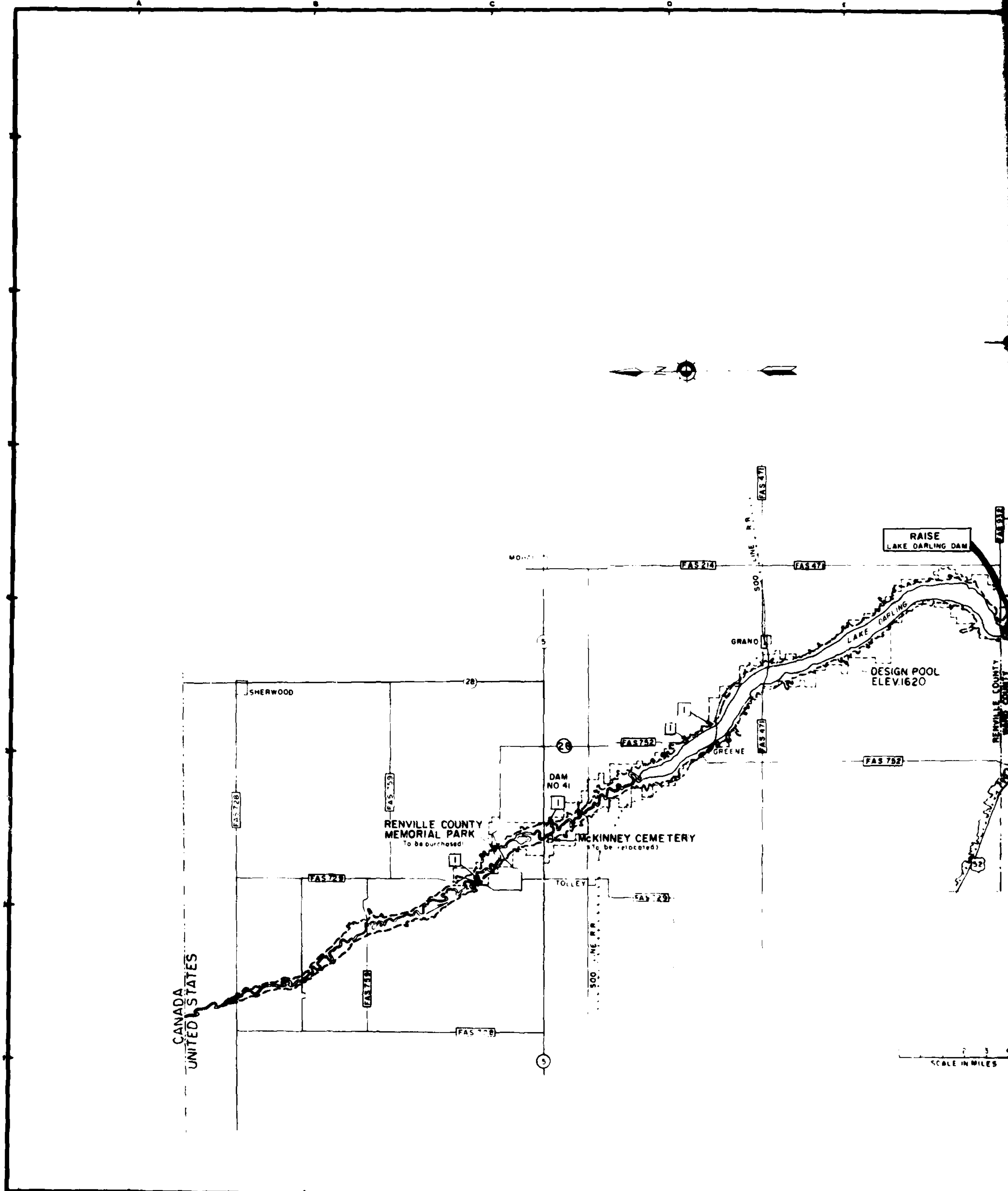
1

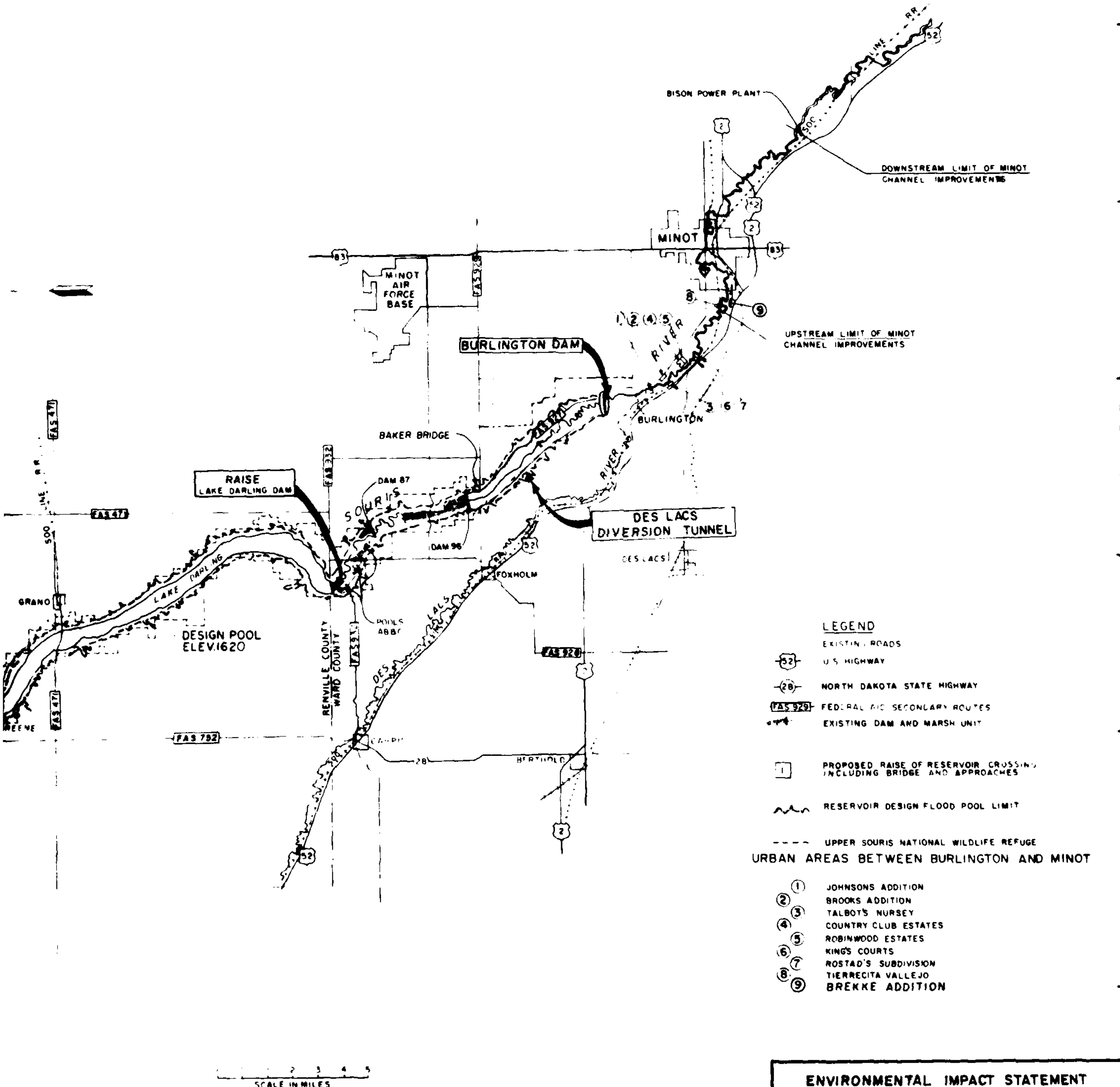


☆U.S.GPO: 1977 765 051/23 Region No 6

PLATE 3

2


RAISE
LAKE DARLING DAM
LAKE DARLING
DESIGN POOL
ELEV.1620
GRANO
GREENE
RENVILLE COUNTY
WARD COUNTY
FAS 471
FAS 214
FAS 752
500 LINE R.R.
DAM
NO 41
RENVILLE COUNTY
MEMORIAL PARK
To be purchased)
McKINNEY CEMETERY
(to be relocated)
TOLLEY
SHERWOOD
FAS 728
FAS 759
CANADA
UNITED STATES
SCALE IN MILES



ENVIRONMENTAL IMPACT STATEMENT

FLOOD CONTROL

BURLINGTON DAM

SOURIS RIVER, NORTH DAKOTA

GENERAL PLAN OF RESERVOIR AREA

ST PAUL, MINN DISTRICT

BURLINGTON DAM AND RESERVOIR

Dam, Spillway and Outlet Works

1.04 The location and features of the proposed dam and reservoir, as shown on plate 3, are similar to the authorized plan except for changes resulting from updated engineering, economic, and environmental analyses. Located 1½ miles northwest of Burlington on the Souris River, the earth fill dam would have a maximum height of 86.5 feet above the stream bed, a crest length of 4,250 feet, and a top width of 32 feet. The crest elevation of 1639.0 would provide 5.0 feet of freeboard above the spillway design flood. The embankment of the dam would consist of a central section primarily of compacted earth fill with 1 vertical on 4 horizontal upstream side slopes and 1 vertical on 3 horizontal downstream side slopes. Uncompacted earth berms would be provided both upstream and downstream of the central section to insure stability of relatively weak clay soils in the foundation of the dam. The upstream face of the compacted embankment would be protected against wave action and erosion with a layer of riprap on a filter blanket. Topsoil with grass cover would be provided to protect remaining embankment surfaces from erosion. The spillway would be an uncontrolled reinforced-concrete weir sill-chute structure 280 feet in width and a reinforced-concrete stilling basin for control of large floods exceeding the reservoir design flood. The low-flow outlet works for the reservoir would consist of two rectangular, concrete, gate-controlled conduits 11 feet wide and 17.5 feet high; an intake structure with slide-gate controlled portals; and a flared stilling basin at the conduit outlet.[1]

Relocations

1.05 Construction of the proposed Burlington Dam and flood storage up to the design pool elevation of 1620.0 would periodically inundate several roads, a railroad, utilities and a cemetery. Federal-Aid Primary 5 (FAP 5), also known as State Highway 5 (SH 5), which is the major traffic carrier across the valley, would be raised to a level 5 feet above the reservoir design pool elevation. Anticipated settlement problems would preclude bridge construction adjacent to high fills in the valley bottom area. Thus, the proposed highway raise would require a new bridge with a river diversion channel at the west edge of the valley. Other proposed highway raises include Federal-Aid Secondary 752 (FAS 752), also known as State Highway 28 (SH 28); FAS 729 (also known as Renville County Road 9); and FAS 932 (also known as Ward County Road 26). These roads have low volumes of traffic but are important to the citizens of the area as school bus and mail routes, for fire protection and ambulance service, and for transportation of farm machinery and produce. Infrequent floods could cause these crossings to be inundated for as long as 7 months.

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[1] Further details on the dam and appurtenant structures are given in Design Memorandum No. 1, Hydrology and Hydraulic Analysis and supplement, and in Design Memorandum No. 2, General, Phase I, Plan Formulation, available at the St. Paul District Office, Corps of Engineers.

The proposed plan includes raising FAS 752 (State Highway 28) and FAS 729 (Renville County Road 9) 5 feet above existing grades, decreasing the frequency of inundation from once in 30 years to once in about 280 years, and constructing a bridge across the spillway at Lake Darling Dam (FAS 932). FAS 932 is also known as Renville County Road 38 or Ward County Road 26. FAS 471 (Renville County Road 28) and FAS 929 (Ward County Road 32) are also important valley crossings for local and commercial traffic. However, even slight raises are costly, and FAS 471 and 929 are not included among roads to be raised. These and other road crossings will have bridges anchored and receive normal postflood maintenance. FAS Route 927, which borders the east edge of the reservoir and serves as an access route to Minot Air Force Base and a school bus route to Burlington, would be rerouted around the dam site. However, the route would be periodically inundated by the reservoir. Thus, another route via existing unimproved roads east of the reservoir would be upgraded to FAS road standards to serve as a substitute route. At the west edge of the dam site a county road would be rerouted to higher ground. The Soo Line Railroad crossing would also be raised by 6 feet over the existing grade, decreasing the frequency of inundation from about once in 40 years to about once in 280 years. Approximately 40 miles of electric power distribution lines and about 40 miles of telephone lines would be affected by the proposed Burlington reservoir and would require removal or relocation. McKinney Cemetery, located one-fourth mile south of State Highway 5 on the west edge of the river valley, contains about 250 graves within a 4.3-acre site. The cemetery would be inundated by flood storage up to the reservoir design pool elevation 1620.0. Due to objections from local interests to relocation of the cemetery, an alternative of approximately equal cost is proposed. The plan would involve placing fill, an average of 12 feet deep, over the cemetery area to the design pool elevation. Grave markers would be relocated directly above their present locations. An alternative of protecting the cemetery with a levee is also being considered. A rural water supply system is being developed in Renville County, between the north boundary of the Upper Souris NWR and the international boundary (see plate 4), with several wells located in the reservoir area. The proposed plan includes modifications to the system to make it operable with reservoir storage.

Real Estate - Above Dam

1.06 At full pool elevation 1620, which would be reached by a 0.04 percent chance flood, approximately 25,500 acres would be inundated, of which a total of about 18,000 acres is in the Upper Souris National Wildlife Refuge, presently in Federal ownership. There is opposition by local interests to removal of private lands from the tax base and to relocation of residences from the reservoir area. The State of North Dakota expressed concern in a letter which proposed permitting residents to remain in the pool area above the 1-percent chance storage elevation. The plan therefore includes fee title purchase of lands

required for project structures (about 800 acres) and private lands upstream from Burlington Dam to the 1-percent chance elevation, presently established at 1605 above Lake Darling Dam and 1602 between Burlington Dam and Lake Darling Dam. Flowage easements would be taken between the 1-percent chance elevation and elevation 1620, with human habitation permitted to remain and including the right to erode and prohibit future construction. Lands taken in fee title include about 7,000 acres within the design flood pool and 4,000 acres of uneconomic remnants above the full pool level. There are about 3,000 acres of private land in the flowage easement area of the reservoir. The plan includes purchase of about 25 sets of buildings in the reservoir area, including 15 farms and 10 non-farm residences. Other relocations include the removal of four sets of maintenance buildings located in the Upper Souris Refuge below Lake Darling Dam and within the flood pool. The existing refuge headquarters buildings located near the left abutment of the dam and above elevation 1625 would remain.

1.07 Renville County Memorial Park is located in a loop of the Souris River about 2 miles north of State Highway 5 and, except for some county-owned property, is privately owned. There are about 120 separate ownerships in the park including 80 cottages, a few of which are permanent residences, and county-owned recreation buildings. The average elevation of the park is about 1600 feet above mean sea level (msl), and the park would therefore be subject to flooding. Accordingly, the plan includes fee title purchase of all lands and developments within the park, even though there is significant opposition to Federal purchase of private and county property at the park. In response to desires expressed by local interests, authorities other than the authority for the flood control project will be investigated to provide substitute recreation facilities compatible with flooding.

Fish and Wildlife Measures

1.08 Refuge Mitigation: The raise of Lake Darling Dam is an integral part of the Burlington dam flood control plan (see plate 4). The dam would be raised 4 feet to control the smaller, more frequent floods, and the slopes would be flattened and riprapped to insure stability. The low-flow conduit and gate would be removed, and a new structure capable of passing 5,000 cfs would be placed at the left abutment. The primary spillway would be raised 4 feet by constructing a concrete weir and stilling basin about 100 feet upstream of the existing concrete overflow sill. The area between the existing and new control structures would be protected against scour with riprap. Concrete sidewalls would be constructed from the new weir to the downstream end of the existing overflow sill. Sections of the concrete sidewalls would also serve as abutments for support of the proposed bridge over the spillway. Existing erosion protection on the spillway would be utilized intact and undisturbed. The grass-lined auxiliary spillway on the right abutment

would also be raised 4 feet using compacted impervious fill, concrete sidewalls would be constructed, and an overflow concrete sill would regulate flow onto a natural slope riprapped for scour protection.

1.09 Refuge dams 96, 87, and 41 in the Upper Souris Refuge (see plate 4) and 320, 326, 332, 341, and 357 in the J. Clark Salyer Refuge would be damaged and/or be less effective during and after operation of Burlington Dam (due to vegetation damage and the need to change refuge management). In accordance with agreements made with U.S. Fish and Wildlife Service (USFWS), they would be modified to insure their continued functioning and manageability with Burlington Dam in place. Modification to the three refuge dams located in the Upper Souris Refuge would include modification to embankments, spillways, and outlet works. The embankments would be constructed to present elevations and would be stabilized as necessary to withstand prolonged periods of inundation (inundation would not cause failure of the dikes). Also, the spillway and outlet conduits of dams 96 and 87 would be enlarged as necessary to pass the maximum outflow from Lake Darling Dam before becoming inundated by storage behind Burlington Dam.

1.10 The dam embankments in J. Clark Salyer Refuge would all be modified and stabilized as necessary to prevent erosion. The spillways and outlet structures would be replaced with larger sized structures capable of passing a discharge of 5,000 cfs plus local inflow from below Burlington Dam. The gates on all refuge dams would be equipped with heaters to facilitate winter operation. Also, the low-flow outlet on dam 357 would be modified to prevent upstream movement of carp during summer and fall releases from the reservoir.

1.11 Habitat Mitigation: To mitigate the loss of wildlife habitat caused by periodic reservoir inundation both within and outside the Upper Souris Refuge, the USFWS has proposed the reclamation of 2,000 acres of existing drained wetlands and reforestation on 1,000 acres of lands needed for the reservoir. The Service has identified 13,600 acres of drained wetlands in Ward, Renville, and McHenry Counties suitable for mitigation, out of which any 2,000 acres could be chosen to meet the mitigation requirements. In accordance with agreements reached with the USFWS, fee title to the habitat mitigation lands would be purchased.

Reservoir Plan of Operation

1.12 The proposed reservoir operating plan provides for maximum downstream urban and rural flood protection consistent with the degree to which fish and wildlife interests have agreed to tolerate impacts in storage areas behind Lake Darling and Burlington Dams. Generally, the operating plan is based on coordinating the operation of Lake Darling and Burlington Reservoir with the flow from the uncontrolled drainage area (the area between Minot and the Burlington Dam) to prevent

discharge at the Minot gage from exceeding 5,000 cfs. Depending on the flood magnitude, the objective is to reduce the flow at Minot to 2,000 cfs by 10 May and 500 cfs by 20 May. (Mid-summer rainstorm runoff would also be held at 500 cfs.) After spring runoff, the Lake Darling pool would be lowered to elevation 1596.0 at which point the USFWS would take over operation of Lake Darling for fish and wildlife purposes. All floods up to one having about a 2-percent chance of occurring during any one year would be regulated by the storage provided behind raised Lake Darling Dam. Floods larger than the 2-percent flood would require storage behind Burlington Dam to avoid flows in excess of 5,000 cfs at Minot. Actual reservoir operation is divided into three phases as follows:

a. Preflood drawdown criteria for Lake Darling.

b. Maximum release plan.

c. Reservoir emptying plan.

1.13 Preflood Drawdown: Prior to 1 March each year the forecast for possible flooding will be evaluated on the following factors:

a. Predicted 30-day flood volume at Sherwood, North Dakota.

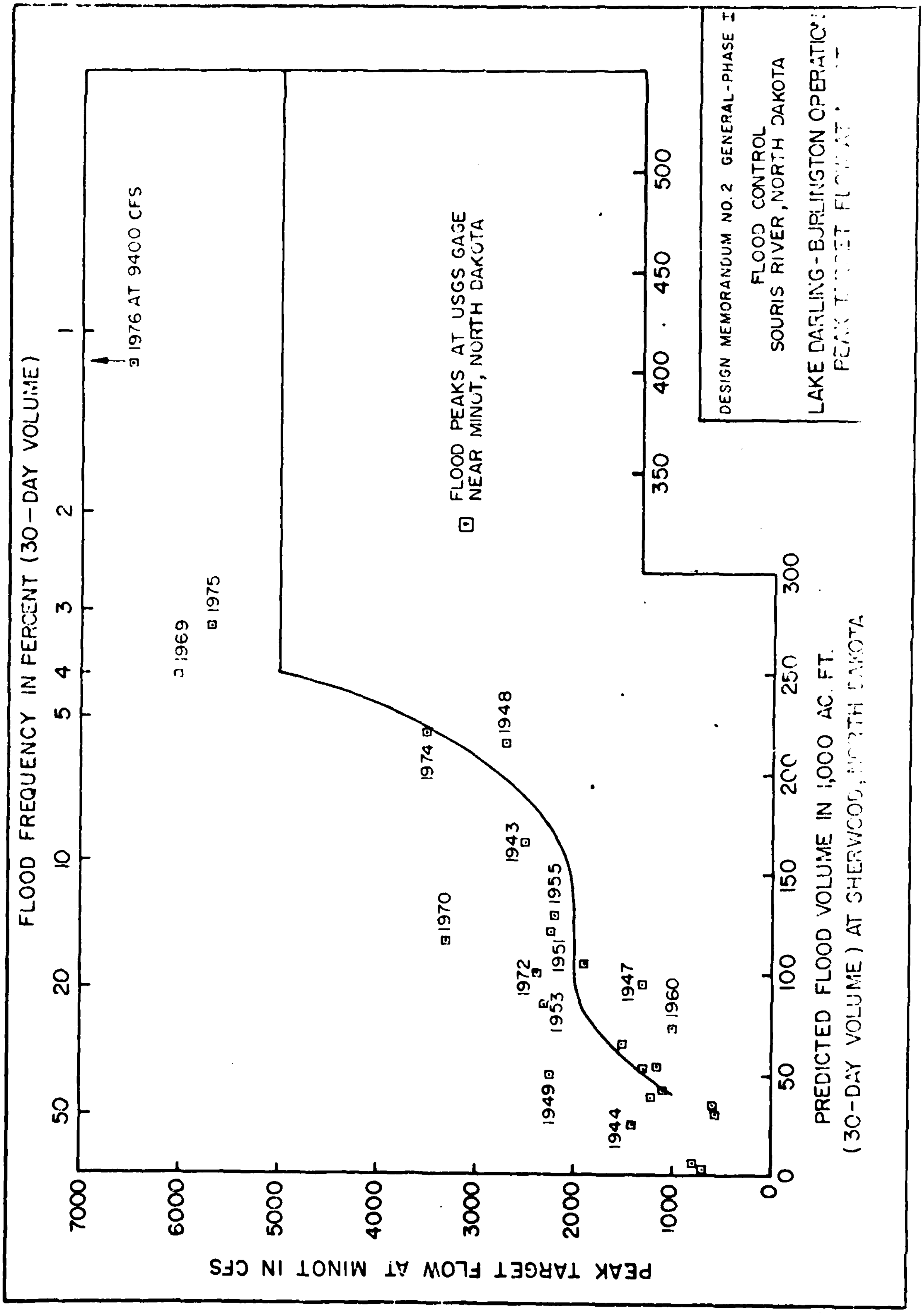
b. Lake Darling pool elevation on 1 March.

c. Drawdown rate of 250 cfs, the estimated average non-damage ice cover release rate.

d. Maximum drawdown to elevation 1591.0 for floods with a predicted 30-day volume at Sherwood of 100,000 acre-feet or greater.

e. Minimum drawdown to elevation 1594.0 for smaller floods.

1.14 Maximum Release Plan: The adopted Lake Darling-Burlington operating plan for all Souris River floods is shown on figure 1. This curve represents a plot of the predicted 30-day flood volume at Sherwood versus the peak target flow at Minot. Floods having a more frequent chance of occurrence than 4 percent at Sherwood would be regulated to insure a Minot peak target flow dictated by the curve. The peak flow would be based directly upon the predicted 30-day flood volume at Sherwood (0-250,000 acre-feet) and the amount of storage available in Lake Darling. Floods having a less frequent chance of occurrence than 4 percent at Sherwood (a predicted 30-day volume of at least 250,000 acre-feet) would be operated to insure a peak flow not exceeding 5,000 cfs at Minot.



DESIGN MEMORANDUM NO. 2 GENERAL-PHASE I
FLOOD CONTROL
SOURIS RIVER, NORTH DAKOTA
LAKE DARLING-BURLINGTON OPERATION
FLOOD FREQUENCY IN PERCENT (30-DAY VOLUME)
PEAK TARGET FLOW AT MINOT IN CFS
PREDICTED FLOOD VOLUME IN 1,000 AC. FT.
(30-DAY VOLUME) AT SHERWOOD, NORTH DAKOTA
FLOOD PEAKS AT USGS GAGE
NEAR MINOT, NORTH DAKOTA
1976 AT 9400 CFS
1975
1969
1948
1974
1943
1970
1955
1951
1972
1953
1947
1960
1949
1944

FIGURE 1

1.15 Reservoir Emptying Plan: The general reservoir emptying criteria are stated as follows: If the predicted 30-day flood volume at Sherwood is between 0-50,000 acre-feet, releases would be adjusted to produce a maximum Minot flow ranging from zero to 1,300 cfs. Actual releases would be controlled according to the interests of the USFWS, which relate to increasing the level of Lake Darling to elevation 1596 as soon as possible.

1.16 If the predicted 30-day flood volume at Sherwood is between 50,000 and 100,000 acre-feet, releases would be adjusted to produce a maximum Minot flow ranging from 1,300 to 2,000 cfs. Again, actual releases would be governed by USFWS concerns related to increasing the level of Lake Darling to elevation 1596. Releases would be cut back to produce a Minot flow of 500 cfs by 20 May.

1.17 If the predicted 30-day flood volume is between 100,000 and 150,000 acre-feet, the releases would be adjusted to produce a maximum Minot flow of 2,000 cfs until the unregulated flow at Minot(1) is reached or until 10 May, whichever is earlier. Minot flow will either follow the unregulated flow recession or would be cut back to 500 cfs on 20 May, whichever is earlier. Minot flow would be held at 500 cfs until Lake Darling is drawn down to elevation 1596.0. Earlier cutbacks in releases may be necessary in some cases to assure that Lake Darling can be filled to elevation 1596.0.

1.18 If the predicted 30-day flood volume is from 150,000 to 225,000 acre-feet, releases would be adjusted to produce a maximum Minot flow ranging from 2,000 to 3,600 cfs. Releases would be cut back to produce a Minot flow of 2,000 cfs by 10 May and held constant until the unregulated flow recession is reached.

1.19 If the predicted 30-day volume is between 225,000 and 275,000 acre-feet, releases would be adjusted to produce a Minot flow ranging from 3,600 to 5,000 cfs. Releases would be cut back to the Minot unregulated flow recession by 7 to 15 May depending on storage reductions in Lake Darling needed to reach elevation 1596.

1.19B If the predicted 30-day flood volume is between 275,000 to 325,000 acre-feet, releases will be adjusted to produce a maximum Minot flow of 5,000 cfs. Maximum releases would continue until 7 to 15 May, depending on storage reductions in Lake Darling needed to reach elevation 1596, or the unregulated flow recession at Minot, whichever is later.

1.20 All floods with predicted 30-day volumes between 325,000 and the design flood would be controlled with maximum releases to produce a Minot flow of 5,000 cfs. Maximum releases would continue to 15 May or the unregulated flow recession at Minot, whichever is later. Releases after 15 May would be cut to the Minot unregulated flow recession or follow the unregulated flow recession at Minot to 500 cfs. Releases would be adjusted to produce a Minot flow of 500 cfs until the Lake Darling pool is drawn down to elevation 1596. Floods larger than 0.5-percent frequency may require flow at Minot of 5,000 cfs beyond 15 May to assure drawdown of the pool before the next flood season or a 2-year storage release schedule. All floods with predicted 30-day

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(1) The unregulated flow at Minot is approximated when reservoir storage is constant and inflow equals outflow.

volumes exceeding 325,000 acre-feet would require some storage in Burlington Reservoir. Lake Darling and Burlington pools would be drawn down concurrently until Lake Darling reaches elevation 1596; and releases would then continue until Burlington Reservoir is empty.

1.21 For all floods it is intended that summer releases through the end of August be held to produce a maximum Minot flow of 500 cfs and fall and winter Minot flows when necessary at a maximum of 700 cfs. Some minor modifications may be necessary in the Lake Darling filling and release rates to accommodate fish spawning.

1.22 Additional details on the reservoir operation plan, including an analysis of the impact of the plan on a range of historic floods, are presented in Design Memorandum No. 1 - Hydrologic and Hydraulic Analysis and supplement thereto.

DES LACS RIVER DIVERSION

1.23 To provide the Minot area with a greater degree of protection from the Des Lacs River than afforded by the Minot channel project, the plan includes diverting the larger flood flows from the Des Lacs River via a tunnel outletting behind the proposed Burlington Dam. The diversion dam and tunnel portal would be located on the Des Lacs River, about 8 valley miles northwest of Burlington, and the tunnel outlet structure and channel would be located on the Souris River about 7 valley miles northeast of Burlington just below FAS 929. The general location and features of the diversion conduit and related works are shown on plate 4. The diversion facilities would include a small earth dam about 1,700 feet long and 6 feet high, designed as an overflow structure with a concrete crest. The ungated conduit through the dam is designed to pass 4,000 cfs. An inlet channel and an uncontrolled concrete weir structure are located at the portal of the tunnel. The tunnel would be concrete-lined with an inside diameter of about 22 feet and a total length of about 1 mile. A concrete chute energy dissipator and channel would be constructed at the outlet end of the tunnel. Diversion would begin when the discharge from the Des Lacs River reaches 1,400 cfs, equivalent to a flood having about a 14-percent chance of occurring in any one year. However, the diverted flow would not be stored behind Burlington Dam until the flow at Minot reaches 5,000 cfs, equivalent to about a 0.4-percent Des Lacs River probability. At design capacity the tunnel would divert a flow of 4,500 cfs. When Des Lacs River flows exceed 8,500 cfs (0.06-percent Des Lacs River probability), the excess flow would overtop the diversion dam. There would be about a 6-percent chance of water overflowing the channel banks immediately upstream of Burlington Dam in any one year, which is similar to existing conditions. Additional details on the diversion are provided in Design Memorandum No. 1, Hydrology and Hydraulic Analysis.

1.24 Approximately 300 acres of land would be required for the diversion dam, inlet channel and control structures, and the diversion impoundment. The purchase of these lands is based on fee title. Lands required for the outlet structures and channel are within the area required for the reservoir. In addition, an easement would be obtained for deposition of spoil from the tunnel and along the alignment of the tunnel, and construction of the tunnel outlet channel would require construction of a bridge on a township road paralleling the west side of the Souris River.

LEVEE UPGRADING AND REAL ESTATE BELOW THE DAM

1.25 To reduce adverse environmental and social effects in the reservoir area and also to increase the degree of Souris River protection, the proposed reservoir operating plan provides for releasing up to a maximum rate of 5,000 cfs at Minot. To accommodate the 5,000 cfs release rate, levee modifications are proposed for subdivision areas between Burlington and Minot and at the communities of Sawyer and Velva, as shown on plates 2 and 3.

1.26 Along the Souris River from Burlington to Minot are nine subdivisions in seven levee systems with emergency levees first constructed by the Corps in 1970 and modified during subsequent flood years. In this reach there are 5.9 miles of levee in seven levee systems which were capable of passing 9,300 cfs during the 1976 flood. However, the levees cannot be relied upon to provide permanent protection as they were constructed under emergency conditions without proper consideration given to meeting engineering standards for foundations, stability, and interior drainage. The emergency levees would be realigned and regraded as necessary to pass a flow of 5,000 cfs with up to 3 feet of freeboard. In places where the levees are constructed between the channel and adjacent development, the channel would be realigned to permit proper design of levee slopes. Riprapping would be included where necessary to prevent erosion of the channel and the riverward slope of the levees. The permanent plan of protection also includes the provision of seven pumping stations, ponding areas, and interceptor ditches and conduits, as necessary.

1.27 At Sawyer and Velva are emergency levees first constructed by the Corps of Engineers during the spring floods of 1969 and 1970 and modified during subsequent flood years to provide temporary protection against flows of up to about 10,000 cfs plus about a 2-foot allowance for freeboard. The proposed plan would upgrade the levees at Sawyer and Velva to accommodate a design flow of 8,000 cfs, equivalent to the maximum 5,000 cfs flow at Minot plus an allowance of 3,000 cfs for flow from the drainage area below Minot.

1.28 At Sawyer, about 0.8 mile of existing levee would be upgraded, as was proposed for the levees between Burlington and Minot. Due to the large ponding area available at Sawyer, no pumping station is necessary. A gate well would be provided in the levee to release ponded water once channel flows recede.

1.29 At Velva, about 1.9 miles of existing levee would also be upgraded and realigned. A channel cutoff is proposed on the upstream end of Velva which offers flood protection for more of the city lands, avoids an erosion problem on the existing channel alignment, and is less expensive. Gated channel barriers would be constructed at both ends of the old channel loop and a control structure would be placed in the new channel cutoff to insure the passage of low flows through the existing channel alignment. Two pumping plants would be required, along with ponding areas, interceptors, and gate wells.

1.30 Included in the real estate plan is the acquisition of flowage easements on about 1,800 acres of farmlands along a 6-mile reach between Towner and the J. Clark Salyer National Wildlife Refuge which are affected by the 500 cfs summer releases.

1.31 There are also 117 farm and non-farm residences in the downstream rural floodplain. For these structures the plan includes measures to accommodate the 5,000-cfs reservoir releases. The measures would be implemented at the option of the owner and could include structural measures, relocation/evacuation, floodproofing, or a compensation payment for adverse social impacts.

1.32 These downstream areas would experience reduced flood stages and thus an economic benefit as compared with the without-project condition. Nevertheless, reservoir releases could damage homes and displace residents. While not all the downstream measures are economically incrementally justified, they are necessary to accommodate reservoir releases and to insure that the project can be operated as originally intended. The costs of these measures are therefore all Federal costs charged to the reservoir project.

CANADIAN COMPENSATORY REQUIREMENTS

1.33 Current studies show that the project's effect on water levels in Saskatchewan is limited to stage increases within the river channel except during extremely rare floods. Thus, economic damages in Saskatchewan are expected to be negligible. In Manitoba, the 500-cfs summer reservoir release would affect a band of bottomlands near Westhope where the existing channel capacity is only about 150 cfs. An estimate of mitigation for these damages was based on an assumption of costs for flowage easements as a percentage of market value of lands. Formal

Statements about impacts in Canada will be presented in a report to the International Souris-Red River Engineering Board.

FLOODPLAIN REGULATIONS AND FLOOD INSURANCE

1.34 In accordance with the recommendations made by the Corps of Engineers during preparation of the 1969 survey report, the city of Minot and Ward County enacted floodplain regulations. The regulations were first adopted in 1971 and were subsequently modified in accordance with recommendations made by the National Flood Insurance Administration to where they now restrict construction of damageable development in the existing 100-year floodplain. The city of Velva located in McHenry County is currently in the process of adopting floodplain regulations. All three governmental entities participate in the national flood insurance program. To date, neither the village of Sawyer located in Ward County nor McHenry County has adopted floodplain regulations and thus does not qualify for benefits under the national flood insurance program.

1.35 The selected plan would not obviate the need for floodplain regulations, since substantial areas, particularly in developing areas adjacent to Minot, would remain susceptible to flooding from a discharge of 5,000 cfs which, with the project, could be equaled on an average of about once every 110 years (existing probability is about once every 25 years). Accordingly, continuance of floodplain regulations and continued participation in the national flood insurance program in Ward County, Minot, and Velva and adoption of these measures in Sawyer and McHenry County are strongly recommended. It should be noted that the Corps of Engineers has no authority to impose floodplain regulations on State or local units of government. This authority rests with the State or local units of government themselves.

1.36 To reduce the risk to life, health and property at Minot, the selected plan would also include the installation of a flood warning system on Gassman Coulee, consisting of a network of electronic recording rain gages and water level indicators that could be continuously monitored by the Corps of Engineers and Minot city personnel.

ECONOMIC ANALYSIS

1.37 Since the project would provide no claimed economic benefits other than those related to flood control, all of the costs are allocated to that purpose. The following table presents a summary of the benefits,

costs and resulting benefit/cost ratio for the selected plan. Based on average annual benefits of $7,762,000 and average annual charges of $5,596,000, the project is economically feasible with a benefit/cost ratio of 1.39.

TABLE 1

Summary of benefits and costs - Souris River flood control plan (1)

	First Costs	Average annual charges	Average annual benefits (October 1977 prices)	Benefit-cost ratio
Burlington Reservoir and related works				
Dam and reservoir (2)	67,600,000	4,176,000		
Levees				
Burlington to Minot	3,700,000	191,000		
Sawyer	330,000	17,000		
Velva	1,970,000	102,000		
Rural Works	3,700,000	191,000		
Des Lacs River diversion	15,300,000	919,000		
Total Burlington Reservoir and related works	92,600,000	5,596,000	7,762,000	1.39

(1) Based on an interest rate of 5 1/8 percent and a 100-year period of analysis starting in 1984 and recognizing projected future trends.

(2) Includes total fish and wildlife mitigation costs of $12,517,000. (The cost of purchasing the mitigation lands is $1,793,000.) The $1,793,000 for fish and wildlife costs is comprised of $413,000 for planting 1,000 acres of trees on project lands and $1,380,000 for 2,000 acres of restored wetlands and improvements on those lands.

2.00 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

CLIMATE

2.01 The Souris River basin has a northern continental climate, characterized by extreme variations in temperature, insufficient rainfall for crops during many years, and moderate snowfall. Records of the National Weather Service show that temperatures have varied from a low of -54° F to a high of 114° F (-49° F to 109° F at Minot). The mean annual temperature is 39° F, and annual precipitation averages 15.5 inches, approximately 75 percent of which falls during the crop season, normally late April through July or August. Average temperatures in Minot are about 66° F during the summer and 11° F during the winter. The average annual precipitation is about 15 inches, and total annual precipitation has ranged from 7 inches in 1934 to 25 inches in 1941. The average annual snowfall of 33 inches constitutes approximately 21 percent of yearly precipitation for the basin, with total annual snowfall in Minot ranging from 100 inches during the winter of 1949-1950 to less than 7 inches during the winter of 1930-1931. Average annual gross evaporation from lake areas in the Souris River basin is estimated at 33 inches, and the net evaporation (gross evaporation less precipitation) is about 18 inches. The growing season averages only 117 days but there is an average of 15 hours of sunlight per day in the summer.

2.02 At Minot the prevailing wind direction is northwest during the winter. During the summer, winds are generally from a southerly direction.

PHYSIOGRAPHY AND GEOLOGY

2.03 The discussion of the physiography and geology of the Souris River basin presented in this section is merely a summary of information available on the area and is intended to provide a background against which the impact of the proposed project can be evaluated. A number of excellent references dealing in a detailed manner with various aspects of the basin geology are available. A list of those references used in the preparation of this section is provided in the literature cited and references section.

Physiography

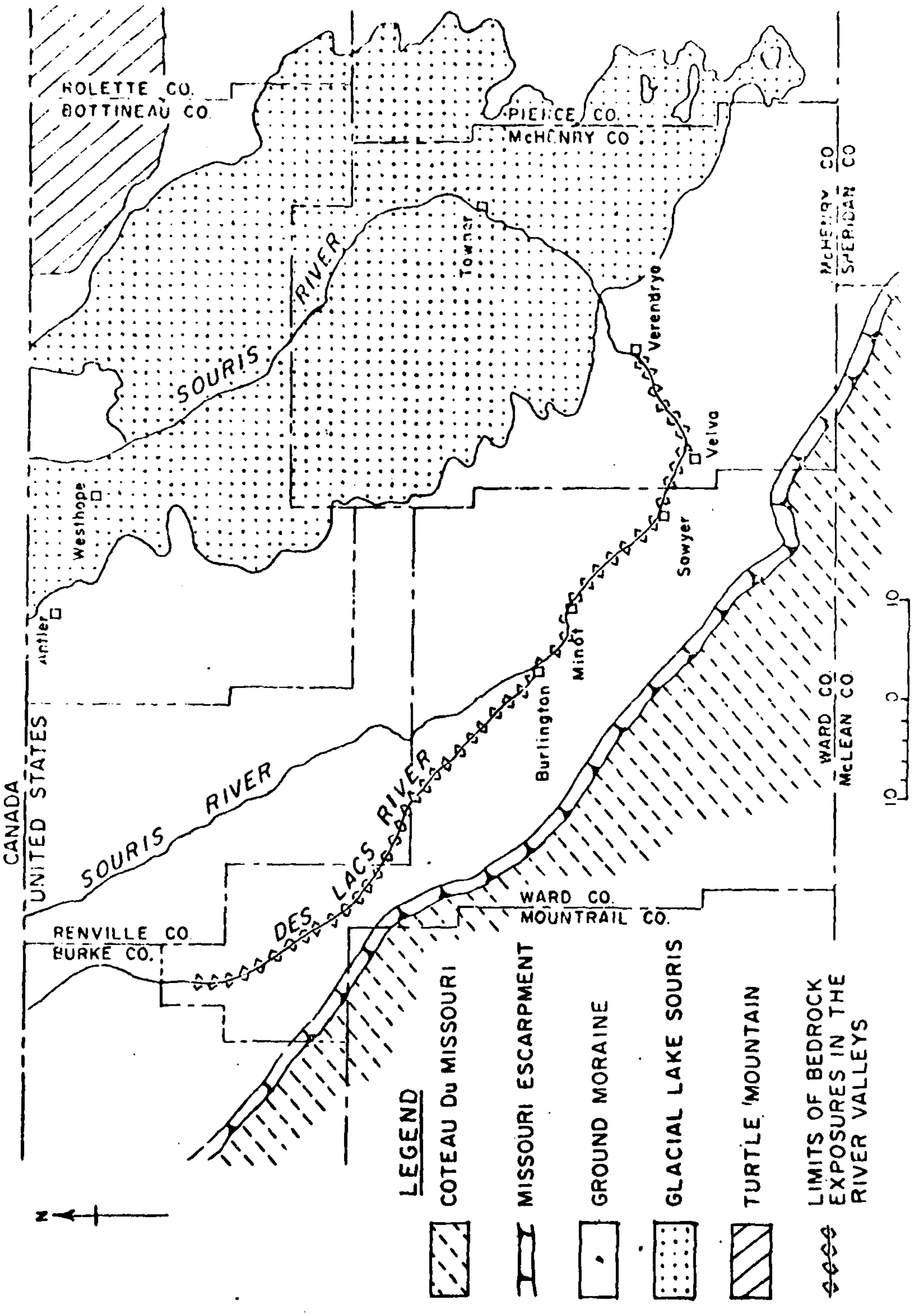
2.04 The Souris River basin includes an area of approximately 24,800 square miles. Of this area, 15,480 square miles are in Canada and 9,320 square miles are in the United States. Except for 30 square miles located in northeastern Montana, the United States portion of the basin is in North Dakota, where it includes all of Renville and Bottineau Counties and portions of Rolette, Pierce, McHenry, Ward, Montrail, Burke and Divide Counties. The basin lies in the Drift Prairie section of the Central Lowland physiographic province and the Coteau Du Missouri which forms the eastern border

of the Great Plains physiographic province. Four major geologic and topographic features further subdivide these major sections. They are the Missouri Escarpment, ground-moraine plain, the lake bed of glacial Lake Souris and the southwest portion of the Turtle Mountain. (See figure 2).

2.05 The Coteau Du Missouri extends across the western portion of the basin where it forms a range of glacial hills and undrained depressions roughly 20 miles wide without an integrated drainage system. The Coteau stands approximately 400 feet above the level of the ground-moraine plain to the northeast. The northeastern margin of the Coteau is known as the Missouri Escarpment, or Coteau Slope, which is a gentle slope from the higher level of the Coteau to the ground-moraine plain. This escarpment or slope forms the boundary between the Great Plains and Central Lowland physiographic provinces.

2.06 The ground-moraine plain comprises over 50 percent of the total basin area. It extends from the Coteau Du Missouri to the center of the basin where it meets the lake bed of glacial Lake Souris. The plain is an undulating surface with numerous round, undrained depressions, low mounds, and elongated ridges. The regional slope of the plain is to the northeast at 50 to 80 feet per mile near the Missouri Escarpment, decreases to 40 feet per mile west of the Souris River, and is as low as 20 feet per mile east of the river. The surface is marked by shallow glacial outwash channels which trend normal to the regional slope. Local relief on the plain, with the exception of the Souris and Des Lacs valleys, is generally less than 30 feet and in places less than 10 feet.

2.07 The entire length of the Des Lacs River valley and that portion of the Souris River valley upstream from Verendrye are in the area of the ground-moraine plain. Both valleys in this area were cut when the rivers were swollen with glacial meltwater and were subsequently aggraded to their present levels after the last glaciers receded from the area. The existing condition in both valleys is, therefore, one of a small stream in an oversized valley. The floor of the Souris River valley lies 100 to 200 feet below the ground-moraine plain, and the valley walls are fairly steep-sided. The presence of short, intermittent drainages that head only a few miles from the river give the valley walls a slightly dendritic form with little or no correlative terrace development. The valley floor averages 3/4 mile in width and forms a relatively flat surface which is broken by a sinuous river channel, meander scars and small alluvial fans. The Des Lacs River valley is similar in form to the Souris River valley in the ground-moraine plain. The valley floor averages ½ mile in width and is incised up to 225 feet below the surrounding plain.



MAJOR GEOLOGIC FEATURES IN THE SOURIS RIVER DRAINAGE BASIN

Fig. 2

2.08 The lake bed of glacial Lake Souris is located in the east-central portion of the basin. This feature is approximately 80 miles long in a northwesterly direction in the United States and 40 to 50 miles wide. It was formed during the last glacial recession when glacial meltwater was dammed by the receding ice mass. The surface is nearly flat and featureless except for occasional sand dunes up to 50 feet in height and numerous depressions which often contain water. The lake bed is bordered on the northeast by a thin strip of ground-moraine and the southwest corner of the Turtle Mountain.

2.09 The Souris River valley downstream from Verendrye is in the glacial Lake Souris area. The valley form in this area varies significantly from that in the ground-moraine plain. The valley width varies from ½ to 3 miles. The valley is entrenched less that 100 feet below the surrounding plain and in places shows practically no valley incision.

2.10 The Turtle Mountain occupies the extreme northeast corner of the United States' portion of the basin. The mountain area is an erosional outlier of the Coteau Du Missouri to the west and forms a moraine-covered tableland approximately 400 feet above the surrounding plain.

2.11 Except for the Missouri Escarpment and the areas bordering stream valleys, much of the drainage pattern within the Souris River basin varies from poorly-defined to noncontributing. Many of the noncontributing areas include numerous small depressions where surface water is trapped.

2.12 The only naturally wooded areas in the basin exist along drainages, the slopes of the Turtle Mountain, and some duned areas in the Lake Souris area. Elsewhere in the basin, the surface is unwooded except where trees have been planted near dwellings and for windbreaks. The basin is sparsely populated with most of the land surface used for pasture or cultivation.

General Geology

2.13 The geology influencing the present environment in the Souris River basin is the product of Tertiary and Quaternary erosion and deposition. Previous intervals of deposition and erosion are recorded in the geologic column, but their importance to the existing environment is restricted to deposits of lignite, water, oil and gas that must be recovered from the subsurface.

2.14 Glaciers invaded the Souris River area several times during the Pleistocene epoch. The most significant invasion was the Mankato Substage of the Wisconsin glaciation which laid down thick deposits of drift that obscured nearly all of the preglacial topography. The major drainages in the basin were eroded during the retreat of this ice sheet. The valleys of the Souris and Des Lacs Rivers were carved at this time by large quantities of water supplied by the melting ice and were subsequently filled to their present levels as the flows diminished.

2.15 No sharp demarcation separates Recent from Pleistocene time. After the last retreat of glacial ice, conditions gradually gave way to those existing today. The glacial features have suffered little from erosion so that the present topography is composed essentially of unaltered glacial features, and integrated drainage has not yet been established in much of the basin.

2.16 Unconsolidated surface deposits in the basin are of two types, Recent alluvium and Pleistocene glacial deposits. The Recent alluvium comprises only a small portion of the surficial materials and consists of clay, silt, and fine-to-medium sand with minor amounts of coarse sand and gravel. The only significant alluvial deposits are in the valleys of the Souris and Des Lacs Rivers where they generally exceed 30 feet in thickness. The glacial material consists primarily of morainal deposits and sediments of glacial Lake Souris. The morainal deposits are composed of an impervious, stony clay till with thin seams, lenses, and short channels of sand and gravel. This material occurs on the Coteau Du Missouri with an average thickness of 100 to 200 feet and varies from 50 to 300 feet in thickness throughout the ground-moraine plain and under the sediments of glacial Lake Souris. The thickness of till in the river valleys is often less than 50 feet, due to erosion by glacial meltwater. Buried preglacial valleys, outwash channels, kames, eskers, overriden ice-contact deposits, river-terrace deposits, diversion channels, and undifferentiated glaciofluvial deposits occur throughout the ground-moraine plain and contain a higher sand and gravel content than the surrounding glacial till. The deposits of glacial Lake Souris range in thickness from a featheredge to more than 70 feet. The material in the Lake Souris area is predominantly silt and moderately to poorly graded sand, with sand and gravel beach and other near-shore deposits.

2.17 The bedrock units exposed or forming the buried preglacial erosional surface in the Souris River basin are, in descending order, the Sentinel Butte, Tongue River and Cannonball Formations of the Fort Union Group of the Tertiary System and the Hell Creek and Fox Hills Formations of the Cretaceous System. Older Mesozoic and Paleozoic beds underlie these formations and consist primarily of shales, limestones, sandstones, siltstones, and evaporites with a total thickness of several thousand feet. The older formations are deeply buried in the basin and except for their economic importance are not discussed in this report.

2.18 The Sentinel Butte Formation, the uppermost bedrock unit in the basin, is present only under the Coteau Du Missouri and is lithologically similar to the underlying Tongue River Formation. The Tongue River Formation is present in the western two-thirds of the basin and in the Turtle Mountain. This unit is a continental deposit composed of interbedded sandstone, siltstone, shale, clay, and lignite. Lateral facies change is characteristic of the unit

so that detailed correlation of beds beyond a local area is not practical. The Tongue River Formation varies from a possible thickness greater than 900 feet under the Coteau Du Missouri to a featheredge near the western shoreline at glacial Lake Souris. The formation is exposed intermittently in the Souris River valley and associated drainages from Velva to the confluence of the Souris and Des Lacs Rivers. Tongue River exposures are present in the Des Lacs River valley upstream from the Souris River to a point 7 miles north of Kenmare. The Cannonball Formation underlies surficial deposits in a strip 5 to 15 miles wide which roughly parallels the western shoreline of glacial Lake Souris. Exposures of the Cannonball Formation occur in the Souris River valley from Verendrye upstream to Sawyer. The unit is a marine deposit which consists of thin, alternate beds of sandstone, siltstone, and sandy shale. The total thickness of the uneroded Cannonball Formation is not known, but the thickness of exposed beds in the vicinity of Sawyer is approximately 40 feet. The Cretaceous Hell Creek Formation, with a known thickness of 240 feet, underlies Tertiary rocks in the western part of the area and underlies surficial deposits in a narrow strip about 5 miles wide near the center of the basin. The formation consists of alternate beds of gray sandstone, siltstone, mudstone, and soft shale. The Cretaceous Fox Hills Formation directly underlies surficial deposits in the eastern one-third of the basin. The formation is chiefly a poorly consolidated, medium-grained, orange-yellow sandstone containing large oval concretions.

2.19 The eroded bedrock surface has a regional slope toward the northeast at a gradient slightly steeper than that of the ground surface. The depth of erosion into bedrock in the Souris and Des Lacs River valleys varies due to local differences in geologic history. The greatest known channel erosion in bedrock is from Verendrye up the Souris and Des Lacs Rivers to a few miles north of Kenmare. Upstream from Lake Darling Dam and downstream from Verendrye, the Souris River has made little or no incision in bedrock. Maximum determined depth to bedrock in the river valleys is in the Minot area where it is known to exceed 250 feet.

2.20 The structural geology of the Souris River basin has not been determined in detail. The regional subsurface structure consists of Paleozoic beds dipping to the southwest, truncated by Mesozic beds that dip less steeply to the southwest. The dip of all the beds is gentle and is obscured by local variations in some areas. The Tertiary beds available for study at the surface exhibit local structural irregularities and lithologic variations that make detailed correlation and structural analysis questionable.

2.21 The basin is structurally stable and without tectonic disturbances of regional or local magnitude. U.S. Coast and Geodetic Survey (1969) shows the basin to lie in zone 1 or a non-critical area that could expect only minor damage from any probable earthquake.

2.22 Landslides, occurring as rotational slump blocks, form prominent features along portions of the valley walls of the Des Lacs River valley and the tributary drainages that enter the valley from the west. The landslides are most prominent where the Tongue River Formation is exposed. These slides are generally inactive except where the toe of the slide is being eroded or has been excavated by man. The slides are not considered a natural hazard in their present condition but should be considered a potential problem in planning any development in the area that would change the existing slopes or drainage conditions.

2.23 Ancient landslides also exist adjacent to the Souris River valley at and upstream from the Lake Darling Dam. The slides are large, crescent-shaped slump blocks that persist ½ to 2 miles away from the river. The slides developed prior to the post-glacial filling of the river valley and are presently stable. The slides do not form a natural hazard and should remain stable under almost any conceivable natural or artificial change in the landscape.

Economic Geology

2.24 Natural resources in the Souris River basin that either have economic value, have had economic value, or have economic potential include lignite, sand and gravel, glacial till, glacial boulders, brick clay, petroleum, natural gas, salt, and groundwater. Except for groundwater which is treated in a separate section, these resources are discussed in the following paragraphs.

2.25 Lignite: Lignite is present in the Sentinel Butte and Tongue River Formations, but its development on a commercial basis is restricted by irregular distribution of beds, thinness of beds and thickness of overlying cover. The only economically feasible method of recovering the material at present is strip mining. Three strippable deposits are known in the basin and are identified in Knox et al. (1972) as the Noonan-Kincaid, Niobe and Velva deposits. These deposits are summarized as follows:

Deposit	Location	*Production in Fiscal Year 1975	Estimated Reserve (1972)
Noonan-Kincaid	Northwest Burke Co.	439,739 tons	15,000,000 tons
Niobe	8 miles west of Kenmare	undeveloped	146,000,000 tons
Velva	13 miles southwest of Velva	339,417 tons	5,000,000 tons

* Production data obtained from Workmen's Compensation Bureau (1975).

2.26 Lignite beds are exposed in abundance along the walls of the Des Lacs River valley and occasionally in the Souris River valley and its tributaries downstream from the mouth of the Des Lacs River. Lignite in the Souris River valley upstream from the mouth of the Des Lacs River is buried under a mantle of glacial till. Numerous small abandoned mine openings are visible along the sides of the Des Lacs River valley and some of its tributaries for a distance of 5 miles upstream and 8 miles downstream from Kenmare. Most of these are slope entry mines less than 2,000 feet long, and nearly all are presently caved and inaccessible.

2.27 Sand and Gravel: Sand and gravel deposits are abundant throughout the basin. Commercial operations are usually developed in river-terrace and diversion-channel deposits. Ice-marginal and outwash-channel deposits are next in importance. Kames, eskers, and overriden ice-contact deposits contain sufficient material for small local projects. The southern part of the Lake Souris area contains huge quantities of sand that are essentially undeveloped. The material from nearly all deposits is adequate for road gravel, and material from most larger deposits can be processed for concrete aggregate. The largest aggregate producer in the basin is the Minot Sand and Gravel Company whose main source of material is large river-terrace deposits on the northwest side of the city of Minot. Geologic maps included in Lemke (1960) show the locations of nearly all known workable deposits.

2.28 Glacial Till: Sandy gravelly clay till is available in unlimited quantities. The till is used primarily for fill in highway construction.

2.29 Glacial Boulders: Glacial boulders are scattered on the surface throughout the Coteau Du Missouri, ground-moraine plain, and river terraces. The boulders are the main source of riprap in the basin and must be collected from scattered piles cleared from farmers' fields or on the surface of uncultivated areas where they are naturally abundant. Stockpiles of oversized material screened from the numerous gravel operations in the basin are also important sources of boulders.

2.30 Brick Clay: Clay for brick manufacture has been mined in the past from several localities. The clays were obtained from the Fort Union Group, alluvium and sediments of glacial Lake Souris. No brick is presently manufactured in the basin; however, huge reserves of clay are available and could be developed if the manufacture of bricks in this area again becomes profitable.

2.31 Petroleum: North Dakota became an oil State in 1951. Oil was not discovered in the Souris River basin, however, until January 1, 1953. Recent production statistics obtained from the North Dakota State Geological Survey (1976, 2 references) show production from the basin in the first half of 1976 to be 13,400,203 barrels.

2.32 Production from all but two of the fields is from the Madison Group of the Mississippian System. The other two produce from the Spearfish Formation of the Triassic System to which the oil probably migrated from the Madison Group. Beds of the Devonian, Silurian and Ordovician Systems are considered to have oil potential but are not developed in the basin.

2.33 Gas: Gas was first found in the basin in 1908 and was developed for local farm use in the vicinity of Westhope, Mohall, Lansford, Maxbass and Deering. This gas was obtained from wells ending in the lower portion of the glacial drift or underlying Tongue River Formation. A gas well was developed in glacial drift at Maxbass in 1957, but produced only a total of 665 thousand cubic feet of gas. Private and commercial development of this gas source has been discontinued. Production records for the oil fields in the basin show significant estimated yields of gas; however, communication with the North Dakota State Geological Survey indicates that the only commercial recovery of gas in the basin is by Energy Operating Corporation located at Lignite.

2.34 Salt: Thick deposits of salt occur in Mesozoic and Paleozic beds west of the Souris River basin. Some of the salt beds extend into the basin, but communication with the North Dakota Geological Survey revealed that no salt is produced in the basin.

Soils

2.35 Soils in the Souris River Basin are developed on parent materials of glacial sediments, recent alluvium and, to a small extent, outcrops of the Tongue River formation. In the major project areas upstream from Minot, the dominant soils are the Barnes-Svea, Barnes and Williams-Bowbells associations which are brown to black, loamy, moderately to well drained soils developed on glacial till and the Zahl-Max-Williams-Velva association which are well-drained loamy soils formed on the till and valley alluvium. These soils all generally cohesive and moderately resistant to erosion.

Groundwater

2.36 Groundwater is an important natural resource in the Souris River basin where its occurrence and quality vary with location and depth. Considerable detailed information on the groundwater conditions in most areas of the basin is available. Akin (1947, 1951), Anderson and Hansen (1957), Hansen (1967), Hutchinson and Pettyjohn (1971), Jensen (1962), Lemke (1960), Pettyjohn (1967-2 references, 1968, 1970) and Simpson (1929) are recommended sources of this detailed information. The scope of this study does not warrant a presentation of more than a summary of groundwater conditions, with emphasis on those features most likely to be affected by the proposed projects.

2.37 Groundwater in the basin is obtained from glacial deposits, recent alluvium and bedrock aquifers. Wells in the glacial deposits are developed in sand and gravel lenses or beds, debris-filled valleys, glacial outwash channels on the till plains, and glaciofluvial deposits in the river valleys. In a few places these aquifers will yield more than 500 gallons per minute of good quality water, but such yields are rare. In many places the aquifers are too thin, are of small areal extent, or the rate of natural recharge is too slow to provide sustained yields of more than a few gallons per minute. Shallow or surficial deposits of sand and river-valley aquifers generally produce water of good quality, but water from the more deeply buried aquifers commonly contains objectionable concentrations of iron, sulfate and dissolved solids.

2.38 Development of recent alluvium is restricted to the river valleys. The alluvium is generally thin and is not considered an important source of water.

2.39 Bedrock aquifers in the basin consist of the Cretaceous Dakota Group, Fox Hills and Hell Creek Formations, and Tertiary Fort Union Group. Water from the Dakota Group is generally saline and is used mainly for pressurizing oil fields. Water from the Fox Hills and Hell Creek Formations is a soft sodium bicarbonate type. The water is of poor quality and not recommended for human consumption. The Fort Union Group produces water from sandy phases and lignite beds. Yields from this source are generally small. The water is generally a sodium bicarbonate or sodium chloride type and is not recommended for human consumption. Gas is present with the water in the Fort Union Group and basal drift aquifers in eastern Renville and western Bottineau Counties. When sufficient gas is present, it lifts the water in a well to the ground surface and causes the well to flow. This gas-lift phenomenon was once common in the area but has decreased appreciably with development of the aquifer.

2.40 Recharge to glacial aquifers, which are the best sources of good quality water in the basin, is slow and consists of local precipitation or infiltration from stream flow and, in some cases, bedrock aquifers. Therefore, development of these aquifers must be planned and monitored carefully so that a continuous supply of water may be maintained. For this reason, large quantities of good-quality water are generally not available for industrial or irrigation uses. In general, the gently rolling till plains of the basin are recharge areas where water can collect and seep to the subsurface. The eastern slope of the Coteau Du Missouri and the Des Lacs River valley form a regional discharge area referred to as the Des Lacs Artesian Discharge Area in Hutchinson and Pettyjohn (1971). This area is characterized by numerous springs and flowing wells. Throughout most of its length, the Souris River valley is a discharge area; however, the quantity of water discharged into the valley is small due to the low permeability of the surrounding sediments. Also, the Souris River loses water by seepage to some of the major river valley aquifers in the Minot area and is an important source of recharge for those aquifers.

2.41 Sufficient groundwater sources have been developed throughout the basin to maintain adequate municipal and domestic supplies, although in some cases the quality of the water in domestic wells probably does not meet standards recommended by the U.S. Public Health Service. The largest user of water in the basin is the city of Minot, which obtains adequate water supplies from the Souris River and from buried-channel and glaciofluvial aquifers known as the Minot, North Hill, South Hill, Northwest buried-channel, Lower Souris and Sundre aquifers. The combined aquifer system has a large areal extent and storage capacity, but unmanaged withdrawals could easily exceed natural recharge. Therefore, the aquifers must be properly managed to insure a continued supply of water for the future. Pettyjohn (1967, 1968 and 1970) has detailed information on the aquifers in the Minot area.

2.42 The area that would be affected by the proposed project is that portion of the Souris River valley upstream from Burlington. One aquifer, referred to as the Burlington aquifer in Hutchinson and Pettyjohn (1971), extends about 3 miles up the Souris River valley from Burlington. The aquifer extends nearly the full width of the valley and has a maximum known thickness of about 88 feet. The aquifer probably would provide an adequate municipal supply for Burlington or sustain a small irrigation system.

2.43 Cross sections of the Souris River valley between Burlington and the international boundary, presented in Hutchinson and Pettyjohn (1971), show that the valley fill generally ranges from 70 to 125 feet in thickness and consists mainly of silt and clay with a few small deposits of sand. Only a few domestic and stock wells are developed in this area. Many wells are less than 20 feet deep and developed in sand and gravel. Several wells near the valley walls yield water from the Fort Union Group. Generally, each homestead has shallow and deep wells. The shallow wells produce hard water for culinary purposes. The deep wells, developed in the Fort Union Group, produce soft water for other domestic uses. Either well may be used for stock. Groundwater from the Souris River valley aquifers in this area is believed to be discharging into the stream, but the quantity of water is small and from spring to fall is probably lost to evapotranspiration.

<u>*Unique Geologic Features*</u>

2.44 The Souris River basin includes some geologic features that could be considered unique on a regional or continental scale. On a basin scale, however, they are major land forms for which the term geologic feature is misleading. Although some persons or groups may consider a particular exposure or glacial deposit unusual or rare, no feature in the basin in known to be generally accepted as unique.

[illegible]

[illegible] relating to the geology of the Souris River basin that [illegible] are nearly nonexistent. The potential for [illegible] exists, of course. Such problems as ground-water shortages, [illegible] contamination, depletion of resources, foundation failures, or pollution resulting from the improper disposal of industrial and human wastes are certainly related to the geology of the area and could become a reality if society fails to use its resources wisely.

SURFACE WATER

2.46 In addition to the Souris River, surface waters in the United States portion of the basin include wetlands and impoundments of Government agencies and private organizations. The projects include a number of reservoirs behind low-head dams on the river and its tributaries, constructed in the interest of irrigation, recreation, stock watering, domestic and industrial water supply, and fish and wildlife propagation, such as the artificial wetlands and lakes of three [illegible] national wildlife refuges. Natural wetlands in the basin are present as prairie potholes in the uplands and oxbow cutoffs in the river valley. The only natural lakes in the basin are small and are located on the Turtle Mountain and in the eastern portion of the basin where small closed drainages form alkaline lakes. The sections on wetlands and existing and authorized water resource projects discuss these surface waters in more detail.

2.47 The Souris River is normally a sluggish stream which forms a complex meandering pattern in the oversized glacial valley. As described in the physiography section, the United States portion of the valley is broad and deep, except in the glacial Lake Souris area downstream from Verendrye where the valley floor is less than 100 feet below the surrounding plain. The river itself is a geologically mature stream, with large meanders and isolated oxbows. Bottom types vary from boulders and gravel to sand, silt, and clay. Downstream from where it enters the United States to its confluence with the Des Lacs River, and also from near Bantry and Upham to where it leaves the United States, artificial lakes impounded by earth dams cover much of the Souris River valley floor. Below the confluence of the Des Lacs River, the Souris River winds tortuously in a steep-walled valley. At Minot the south valley wall reaches a height of about [illegible] feet while the north valley wall is 50 feet lower. Many small tributaries, some of which rise in the Max Moraine, are deeply cut in the south valley wall. Few tributaries enter from the north due to the northeast slope of the adjacent upland.

2.48 Within the United States the primary channel of the Souris River averages about 80 feet in top width and 12 feet in depth. The top width in the Minot area varies from 50 to 90 feet. Due to meanders, the river's length is about twice that of the valley through which it winds. Average slopes in various reaches of the Souris River in North Dakota are as follows:

Western international boundary (mile 512.7) to Minot (mile 377.7)	0.47 foot per mile
Minot to Towner (mile 254.8)	0.76 foot per mile
Towner to eastern international boundary (mile 154.5)	0.42 foot per mile

The portion of the Des Lacs River extending from Foxholm to its confluence with the Souris River is 20 miles long, with an average channel width of 30 feet and an average channel depth of 5 feet.

Surface Water Uses

2.49 Present surface water uses and demands are given in the following paragraphs:

2.50 Canada: The Province of Saskatchewan has the right to use up to 50 percent of the water originating in the Saskatchewan portion of the Souris basin, but the flow at the Saskatchewan-North Dakota border near Sherwood should be not less than 4 cubic feet per second (cfs) when possible. If Canada exercised its rights to one-half of the water originating in Saskatchewan, the quantity of water available to water users in North Dakota would be significantly decreased. Each year, North Dakota must also deliver to the Province of Manitoba during June through October 6,069 acre-feet of water, so far as practicable, at a rate of 20 cfs at the Westhope crossing. Detailed information concerning the cited committments for water rights is contained in the International Joint Commission (IJC) Order dated March 19,1958.

2.51 Municipal and Industrial: There are approximately 101,000 people living in the North Dakota portion of the Souris River basin. Thirty-three communities with a total population of about 58,800 have water supply systems and all use groundwater as a source of supply, with Minot and Westhope using Souris River water to augment groundwater supplies. Minot, which has a population of slightly over 32,000, is the major population center and has a water rights claim of up to 6,900 acre-feet of water annually from the Souris River, subject to prior appropriation by the USFWS for the Upper Souris and J. Clark Salyer refuges. This water from the Souris River supplies about one-third of the 4.5 million gallons per day average use for Minot, which also has a contract to supply water to the Minot Air Force Base. Westhope, with a population of about 700, has water rights of 1.86 acre-feet per day from the Souris River. No data are available on how much Westhope takes from the river, but the demand is small. Industry is normally confined to the major urban areas, and present use of water from the Souris is minor.

2.52 Rural: Domestic use, including communities without municipal supply, farmsteads, and the rural populace, may take as much as 2.1 million gallons per day which is obtained almost exclusively from groundwater sources. Livestock requirements could have a gross demand of about 4.5 million gallons per day. This demand is well distributed throughout the basin and would be principally supplied from groundwater sources with surface water being used where available.

2.53 Irrigation: At this time, irrigation is of relatively little importance in the Souris basin because of a shortage of available water. The principal existing users of surface water for irrigation are the Judge A. M. Christianson irrigation project and the Eaton Flood Irrigation District. The Judge A. M. Christianson project is located near the junction of the Des Lacs and Souris Rivers and has permits to divert up to 2,428 acre-feet of water from the Souris and Des Lacs Rivers. The Eaton Flood Irrigation District near Towner, North Dakota, has a permit to flood irrigate 8,000 acres of native grass hayland with approximately 10,000 acre-feet of Souris water each spring. The State of North Dakota has granted permits for the annual use of 1,346,000 acre-feet of water for irrigation in the Souris basin. Of this, approximately 1,320,000 acre-feet were granted to occur under the Garrison Diversion plan. The city of Minot also has an agreement with the Garrison Diversion Unit to receive up to 23,000 acre-feet for municipal supply.

2.54 Migratory Waterfowl: The USFWS operates and maintains three national wildlife refuges in the Souris basin. The impoundments in the refuges have an aggregate storage volume of about 213,500 acre-feet. Lake Darling is the largest, having about 112,000 acre-feet of storage. The USFWS has acquired appropriative water rights under North Dakota statutes which are dedicated to creating favorable environments for waterfowl. Water for any other purpose is available only by agreement with the Service. Evaporation from these impoundments during a normal year would be about 35 inches and at optimum pool levels would be about 67,000 acre-feet of water. This evaporative loss makes the USFWS the largest single consumptive water user in the North Dakota portion of the Souris River basin.

WATER QUALITY OF THE SOURIS RIVER

2.55 The waters of the Souris River are marginal in respect to both quality and dependability of supply. Flows are highly variable, with annual runoff at Minot ranging from a low of 940 acre-feet in 1931 and 1937 to a high of 801,000 acre-feet in 1976. Flows are usually greatest in April and May due to runoff from snowmelt and general spring rains. Flows are generally very low during fall and winter with periods of no flow occurring often, sometimes extending for days and months at a time. Water quality data for two days from the Sherwood sampling stations, where the Souris River enters North Dakota, is shown in table 2. These two days are considered to be representative of high and low flow conditions. The region is characterized by thousands of small, undrained or poorly drained shallow prairie potholes which store much of the runoff. These potholes constitute about 90 percent of the surface water area in the North Dakota portion of the basin.

TABLE 2 - CLASS IA WATER QUALITY REQUIREMENTS

Substance or Characteristics	North Dakota Limitation	Water Quality Data Sherwood Station	
		21 Jan 1975 Discharge 5.1 cfs	15 May 1975 Discharge 4280 cfs
Ammonia (un-ionized) as N (Diss)	.02 mg/1	.76 mg/1	.06 mg/1
Arsenic (total)	.05 mg/1	-	-
Barium (Diss)	1.0 mg/1	-	-
Boren (Diss)	0.5 mg/1	.31 mg/1	.2 mg/1
Cadium (total)	.01 mg/1	-	-
Chlorides (Diss)	175 mg/1	85	7.5
Chromium (total)	.05 mg/1	-	-
Copper (total) (1)	.05 mg/1	-	-
Cyanides (total)	.005mg/1	-	-
Lead (Diss) (1)	.05 mg/1	-	-
Nitrates (N) (Diss) (2)	1.0 mg/1	1.2 mg/1	.41 mg/1
Phosphates (P) (Diss)(2)	0.1 mg/1	-	-
Zinc (total) (1)	1.0 mg/1	-	-
Selenium (total)	.01 mg/1	-	-
Polychlorinated Biphenyls (total)	.001mg/1	-	-
Dissolved Oxygen (not less than)	5.0 mg/1	2.3 mg/1	7.3 mg/1
pH	7.0-8.5	7.4	7.8
Temperature	85 degrees F Max. Increase not more than 5 degrees F above natural background conditions	32 degrees F	57 degrees F
Fecal Coliform	Not exceed geometric mean of 200 per 100 ml based on a minimum of not less that 5 samples obtained during separate 24-hour periods for any 30-day period, nor shall 10 percent of total samples exceed 400 per 100 ml. Only applies to recreational season 1 May to 30 Sept.	10 Result based on colony count outside range	8 Result based on colony count outside range
Sodium	60% of total cations as m Eg./1	40	31
Phenols	.01 mg/1	-	-
Sulfates (Diss)	450 mg/1	270	84
Total Chlorine Residual	.01 mg/1		
Mercury (Total)	.002mg/1	-	-

(1) More restrictive criteria may be necessary to protect fish and aquatic life

(2) Standards for nitrates & phosphates are intended as guideline limits. Department reserves right to review and to set specific limitations.

2.56 The concentrations of chemical and biological constituents of the surface waters vary greatly with flow. Dissolved oxygen often drops to zero during winter ice cover conditions. The North Dakota State Health Department has observed that variability in stream flows is an important factor to be considered in water quality control. Based on their stream monitoring and sampling program, they have noted that stream water quality, following spring thaw runoff or rains and during high flows, will usually have the following characteristics as compared to low flow conditions: (1) increased coliform counts (2) lower total dissolved solids, and (3) generally no drop in phosphates corresponding to the lower total dissolved solids.

WATER QUALITY OF THE DES LACS RIVER

2.57 The water quality and flow regime of the Des Lacs River is similar to that of the Souris River in that its water quality is adversely affected by seasonal low flow periods and the influence of wildlife refuge impoundments.

2.58 The Des Lacs NWR on the upper Des Lacs River contains 8 low-head dams which serve to regulate water levels and also provide some flow regulation from Upper Des Lacs Lake, which is the largest and uppermost of the impoundments. The water quality of these impoundments and the Des Lacs River was investigated by the Environmental Protection Agency (EPA) during the 1969 Souris River Basin Water Quality Study It was found that the shallow refuge impoundments, in combination with the high nutrient concentrations and lush growths of emergent aquatic vegetation, contribute to frequent algal blooms. Algal blooms and other plant growth remove nutrients from the water which may be incorporated into bottom sediments when the plants die and settle to the bottom. Large amounts of organic detritus present in the refuge impoundments exert an oxygen demand which results in low dissolved oxygen concentrations.

2.59 Benthic samples taken on the Des Lacs River contained numbers and kinds of organisms indicative of eutrophic conditions. Water quality improves in the lower reaches of the Des Lacs River below the refuge impoundments. Pollution-intolerant organisms were observed near the confluence with the Souris River, indicating that the river had recovered sufficiently to support sensitive organisms throughout the year.

2.60 Water quality data for the Des Lacs River at the Foxholm gage are shown in table 2A. The data shown are arbitrarily selected but are indicative of water quality conditions during ice cover, high flow conditions during spring runoff and for a low flow period during late summer.

TABLE 2A - DES LACS RIVER WATER QUALITY SAMPLING DATA

Substance or Characteristic	Water Quality Data Foxholm Station		
Date	10 Dec. 1975	22 Apr. 1975	7 Aug. 1975
Flow	17 cfs	1280 cfs	59 cfs
Specific Conductance (micro-ohms)	1500	405	1110
pH	7.7	7.8	8.4
Temperature (Deg C)	0	2.0	22.0
Hardness (Ca,Mg)	490	150	350
Alkalinity ($CaCO_3$)	370	85	305
Carbon Dioxide (CO_2)	14	-	-
Sulfate (SO_4)	480	110	300
Chloride (Cl)	22	12	12
Silica (SiO_2)	9.1	3.2	10
Dissolved Solids	1140	337	796
Boron (B)	.080	0	.48
Iron (Fe)	.02	.68	.19
Manganese (Mn)	2.60	.1	.01
Nitrate (N)	-	3.4	1.0
Orthophosphorus (P)	-	.13	-

North Dakota Stream Classification

2.61 The State of North Dakota has classified the Souris River as a IA Stream. The quality of waters in this class permits the propagation and/or life of resident fish species and the waters are suitable for boating, swimming, and other water recreation. The treatment for municipal use may require softening, and the treated water is required to meet bacteriological, physical, and chemical requirements of the State Health Department for municipal use. The quality of the water also permits its use for irrigation, stock watering, and wildlife use without injurious effects. The requirements of this IA class of water are as shown in table 2. For a discussion of Lake Darling's classification, see paragraphs 2.71-2.73.

Water Quality Stations

2.62 Current data (data provided from the U.S. EPA STORET system) show 51 water quality stations in the Souris River basin upstream from and including the station at Westhope, North Dakota. Of these stations, 22 are on lakes, 16 are located on tributaries, and 13 are on the mainstem of the Souris River. The U.S. Geological Survey, North Dakota Game and Fish Department, North Dakota State Department of Health, And Environment Canada, Water Quality Branch are the principal reporting agencies. The Corps of Engineers, St. Paul District, provides funding for several of the stations.

2.63 The lake data being taken are generally restricted to dissolved oxygen concentrations on a yearly basis. Most of the tributaries are sampled on a quarterly basis with several being on a monthly basis. The data for the major mainstem stations are usually taken on a monthly basis with some of the physical parameters such as temperature and specific conductance taken on a daily basis.

Sources of Pollution

2.64 There are no municipalities discharging untreated wastes into the Souris River or its tributaries in North Dakota. The generally accepted method of waste treatment in this area is the waste stabilization pond system. State designed standards require that these facilities provide a minimum of 180 day storage. Those municipalities not presently meeting the 180 day storage requirement will be upgrading their systems in the near future. Discharges are allowed only after effluent quality standards are met and State approval is granted. It is the policy of the State and municipalities that discharges not occur during the winter period when the streams are ice covered and flows are low.

2.65 Industrial wastes are considered to be minor. North Dakota is not a highly industrialized State, and the State has only 16 permits that are considered to be major industrial waste discharge permits. All permits for industry, major and minor, have been issued. In general, all industries are in compliance with their permit conditions.

2.66 Non-point source pollution is a major factor to be considered in the water quality of the streams in the Souris basin. The North Dakota State Health Department has noted that the quality of surface waters has not improved comparatively with the rapid advances that have been made by municipalities, industries and other point sources in providing adequate treatment of their wastes. The North Dakota Health Department has estimated total nitrogen (N) and phosphorus (P) for both point and non-point sources in the basin. These data are shown in table 3. Data show that the non-point sources account for 88 percent of the total N and 82 percent of the total P. Reduction in these loadings from non-point sources will require improved land treatment practices which will be costly and will take a relatively long time to implement.

TABLE 3

Nutrient Sources in the Souris River Basin

Source	Total N Million lb/yr	Total P Million lb/yr
Point	.31	.15
Non-point	2.26	.69
Total	2.57	.84

Water Quality of Existing Reservoirs

2.67 About 230 dams and reservoirs have been constructed in the North Dakota portion of the Souris River basin. One-hundred-and-forty-two of these dams have individual storage capacities of less than 50 acre-feet. The impoundments constructed in the three migratory waterfowl refuges by the U.S. Fish and Wildlife Service constitute the principal storage in the basin. The morphometry of the principal mainstem Souris and Des Lacs River impoundments is shown in table 4.

TABLE 4
Principal Mainstem Souris and Des Lacs River Impoundments

Impoundment	River Mile	Reservoir Capacity Acre-Ft.	Surface Area Acres	Maximum Depth Ft.	Mean Depth Ft.	Primary Purpose
Souris River						
USFWS Service Dam 41	471.1	3,224	728	16.5	4.4	Migratory waterfowl refuge
USFWS Service Lake Darling	429.9	121,600	11,800	25.9	11.3	Migratory waterfowl refuge, water storage
USFWS Service Dam A	429.0	114	57.5	4.5	2.0	Migratory waterfowl refuge
USFWS Service Dam B	427.7	252	193	4	1.3	Migratory waterfowl refuge
USFWS Service Dam C	426.6	258	135	5.5	1.9	Migratory waterfowl refuge
USFWS Service Dam 87	425.7	1,320	323	16.0	4.1	Migratory waterfowl refuge
USFWS Service Dam 96	416.7	2,884	943	15.0	3.1	Migratory waterfowl refuge
Eaton Dam	269.7	1,650	-	-	-	Irrigation
USFWS Service Dam I	205.0	1,000	-	-	-	Migratory waterfowl refuge
USFWS Service Dam 320	194.0	10,000	2,666	9.9	3.7	Migratory waterfowl refuge
USFWS Service Dam 326	195.7	5,500	3,129	7.7	1.8	Migratory waterfowl refuge
USFWS Service Dam 323	179.9	5,371	3,115	9.0	1.7	Migratory waterfowl refuge
USFWS Service Dam 341	171.12	5,050	2,341	8.0	2.1	Migratory waterfowl refuge
USFWS Service Dam 357	155.4	21,600	6,842	10.4	3.2	Migratory waterfowl refuge
Des Lacs River						
USFWS Service Upper Des Lacs Lake		38,000	4,700	10.0	8.1	Migratory waterfowl refuge
USFWS Service Dam 2		278	136	5.0	2.0	Migratory waterfowl refuge

TABLE 4
(cont.)
Principal Mainstem Souris and Des Lacs River Impoundments

Impoundment	River Mile	Reservoir Capacity Acre-Ft.	Surface Area Acres	Maximum Depth Ft.	Mean Depth Ft.	Primary Purpose
USFWS Service Dam [illegible]		49	44	3.0	1.1	Migratory waterfowl refuge
USFWS Service Dam 4		4,900	713	7.6	6.8	Migratory waterfowl refuge
USFWS Service Dam 4A		55	31	4.0	1.8	Migratory waterfowl refuge
USFWS Service Dam 5		140	130	3.5	1.1	Migratory waterfowl refuge
USFWS Service Dam 6		426	239	4.5	1.8	Migratory waterfowl refuge
USFWS Service Dam 7		870	172	7.5		Migratory waterfowl refuge
USFWS Service Dam 7A		1,858	264	8.2		Migratory waterfowl refuge
USFWS Service Dam 8		349	114	9.0		Migratory waterfowl refuge
Judge A.M. Christianson Project						Irrigation
Unit 1		370				
Unit 2		320				

2.68 These shallow impoundments have an influence on the water quality of the Souris River. The Environmental Protection Agency investigated conditions in Souris basin during the summer and fall of 1969. A summary of the conclusions of their report is that water quality conditions reflected a river and impoundment system which were basically eutrophic. Nutrient conditions, especially phosphorus, were adequate to support algal blooms, and intense blooms of blue-green algae have occurred, causing nuisance conditions. Background levels of degradable organic materials derived from decaying vegetation in the shallow fish and wildlife impoundments exerted a significant oxygen demand resulting in depressed dissolved oxygen concentrations at some locations.

2.69 Biochemical Oxygen Demand (BOD) was also determined for the waters and was found to be relatively uniform with BOD_5 sample values ranging from a minimum of 1.8 mg/l in Lake Darling to a maximum of 7.0 mg/l in the downstream J. Clark Salyer Refuge. Mean BOD_5 values ranged from 2.0 to 4.4 mg/l, and rate constants varied from 0.06 to 0.23 mg/l, with a median value of 0.16 for the Souris River. Ultimate BOD ranged from 3.2 to 6.3 mg/l, with an average value of about 4.5.

2.70 Bottom sediment samples were also analyzed during this survey. Dry weight organic carbon in the sediments ranged from 0.70 to 9.7 percent; dry weight organic nitrogen ranged from 0.05 to 0.90 percent; and phosphorus varied from 0.026 to 0.18 percent. The sediments were characterized by large amounts of organic detritus and vegetative material. The sediments from Lake Darling appeared to have a greater deposition of organic detritus.

2.71 Lake Darling: Recent survey data by the U.S. Environmental Protection Agency (EPA) indicate that Lake Darling is eutrophic and ranked last in overall trophic quality (six parameters) when compared with 13 other North Dakota lakes in 1974. For the year 1974, total phosphorus loading to Lake Darling was 0.48 $g/m^2/yr$ or 1.6 times that proposed by Vollenweider as a "dangerous" limit for eutrophic loadings, i.e., it would result in eutrophic conditions in a natural lake with similar mean length and mean hydraulic retention time (1.4 years). It was also estimated that 91 percent of the total phosphorus loading and 77.5 percent of the total nitrogen loading were from non-point sources upstream of Lake Darling.

2.72 Lake Darling currently experiences intense algal blooms during the summer. These blooms are composed almost entirely of the blue-green alga Aphanizomenon flos-aquae (Ulrich and Pfeifer, 1976). Die-offs accompanying algae blooms exert high demand on dissolved oxygen and can cause the deeper-water areas of the lake to become anoxic. If die-offs are rapid and large enough, dissolved oxygen can be reduced to a point where fish and invertebrates are stressed, even to the point of death.

2.73 Low dissolved oxygen conditions have been a problem in the past in Lake Darling, especially during the winter when reduced photosynthetic activity coupled with increased sediment/water ratios due to drawdown can lead to "winterkill" conditions. Such a situation occurred in 1967 when low dissolved oxygen resulted in a die-off of many walleye, northern pike, yellow perch, and white suckers. At the time of the die-off, the water level was at elevation 1593.6 in anticipation of spring flood storage.

Downstream of Lake Darling

2.74 The area between Lake Darling and Baker Bridge (downstream extent of Upper Souris NWR) is a composite of meandering river and impounded marsh units. This stretch of river, extending to the confluence with the Des Lacs River, is influenced heavily by discharges from Lake Darling and the marsh impoundments. Table 4A shows the influence of Lake Darling Reservoir on flow and selected water quality parameters.

2.75 In October 1975, the algal concentrations below Lake Darling were measured at about 9,600/ml indicating the excessive bloom conditions in Lake Darling at that time. Comparable concentrations were noted downstream to the junction of the Des Lacs. Phytoplankton in this reach were characteristic of organically polluted waters (Ulrich and Pfeifer, 1976).

2.76 The macroinvertebrates collected in this reach had a similar pollution index value to those for most reaches of the river, i.e., were indicative of enriched conditions.

2.77 In general, the substrate of the Souris River consists primarily of silt, sand, and organic muck. Very little rock/gravel substrates exist except below low head dams where the increased velocity results in a cleansing action.

2.78 The river reach from Burlington to Minot has already been subject to clearing and snagging in association with the Minot channel project. The number of macroinvertebrates collected in this segment were similar to those within the NWR. However, from the confluence of the Des Lacs downstream to Sawyer, the total number of individuals and taxa collected were less than those found in upstream reaches. The most severely degraded reach was from the Minot Water Treatment plant (river mile 384.1) to at least 16 miles below Minot. Reduced standing crops in this reach were due to channel construction in Minot which has resulted in heavy siltation, lime sludge deposits from the wastewater treatment plant, and effluent from the Minot wastewater treatment plant. This latter influence was detected by a characteristic gray water color that persisted downstream for nearly 23 miles and by growths of the sewage slime, Sphaerotilus, in this reach.

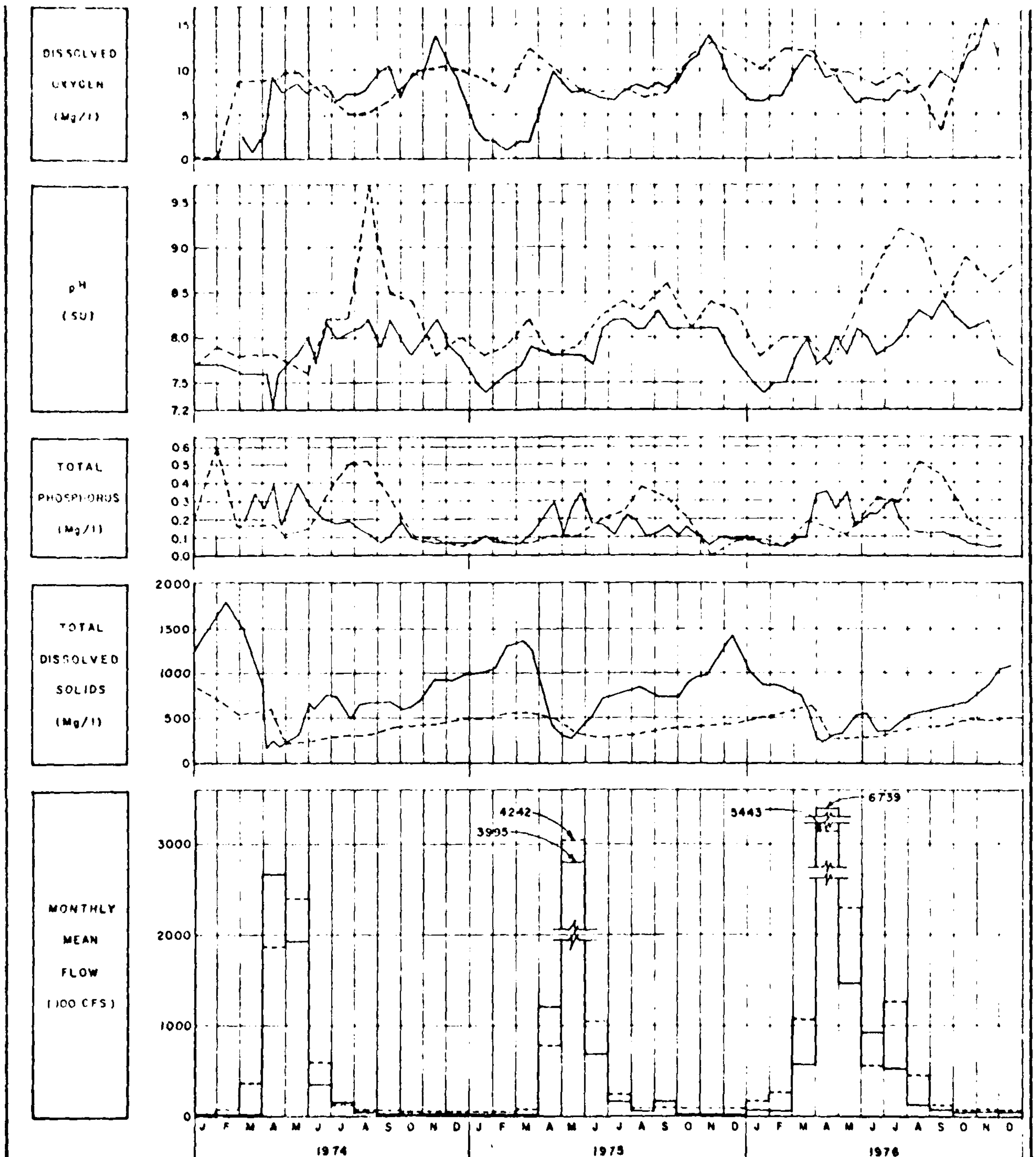


TABLE 4A

DESIGN MEMORANDUM NO. I
SUPPLEMENT NO. I
FLOOD CONTROL
SOURIS RIVER, NORTH DAKOTA

INFLUENCE OF LAKE DARLING RESERVIOR ON FLOW AND WATER QUALITY

ST. PAUL, MINN. DISTRICT

FILE NO. JULY 1977

2.79 Algal populations from Lake Darling to the confluence with the Des Lacs were predominantly blue-green, while the Des Lacs contained more green algae and diatoms. From the confluence of the two rivers the phytoplankton composition gradually changed to predominantly green species. Practically all areas were characterized by pollution-tolerant forms, however.

2.80 Almost every site sampled in October 1975 exhibited species indicative of enriched conditions, almost to the polluted category.

EXISTING AND AUTHORIZED WATER RESOURCE PROJECTS

U.S. Fish and Wildlife Service

2.81 During 1935 and 1936 the USFWS constructed and placed in operation three migratory waterfowl refuges in the Souris River basin. One refuge is located on the Des Lacs River and two on the Souris River. The Des Lacs project consists of a series of nine dams in the vicinity of Kenmare to regulate water levels on artificially created wetlands in the upper reach of that river, plus a regulated outlet for Upper Des Lacs Lake. The J. Clark Salyer project extends from east of Bantry downstream to the international boundary, and it contains waterfowl habitat which is impounded by a series of six low dams. The Upper Souris project, located along the Souris River northwest of Minot in Ward and Renville Counties, is a series of seven dams and reservoirs, but differs from the other projects in that it includes a large storage reservoir known as Lake Darling, created by a dam located at the Ward-Renville County line.

2.82 The Lake Darling Dam, a compacted, earth-fill structure about 2,500 feet in length and 30 feet in height, includes a 320-foot uncontrolled spillway section adjacent to the left abutment. There is also a grass-lined auxiliary spillway on the right abutment. Top width of the dam is 31 feet, and the elevation at the top of the dam is 1606 feet above mean sea level (msl). Side slopes vary from 1 vertical to between 2 ½ and 3 horizontal. The structure includes a 12-foot berm at elevation 1585.0 on both upstream and downstream slopes. The main spillway has a flat crest at elevation 1598.0 and a sloping apron of concrete and rubble masonry extending about 350 feet downstream, which discharges overflow waters onto a grass slope leading to the floodplain below the dam. The reservoir is regulated through operation of two, gated, 10- by 12-foot concrete conduits (bottom elevation at 1577.0), which pass through the dam and discharge into a stilling basin.

2.83 Lake Darling Reservoir has a capacity of about 121,000 acre-feet at existing spillway elevation 1598.0 and at that elevation forms a lake with a surface of about 12,000 acres that extends up

the valley about 27 miles. Mean depth of Lake Darling is about 11 feet, with a maximum depth of about 26 feet near the dam.

2.84 Lake Darling's primary purpose was to provide a regulated water supply for the marsh impoundments immediately downstream, and especially for the impoundments in the J. Clark Salyer NWR. Because it is the only structure capable of any significant flood storage, however, it has been and continues to be operated by the USFWS to provide a maximum amount of flood protection to downstream urban areas. Based on runoff predictions upstream of the dam, Lake Darling is drawn down below normal pool elevation 1596. The amount of drawdown depends on the predicted runoff, downstream channel capacities, and impact to existing fishery resources.

2.85 During the past 10 years, Lake Darling has been drawn down an average of 5.2 feet (3.0 to 7.3 feet) to elevation 1592.8. Some of the drawdown was a result of prior year water usage for fish and wildlife purposes. Other years the reservoir was drawn down during winter and spring to provide storage for flood control. Drawdown reduces the amount of space available for fish and increases the ratio of sediment to water volume, creating conditions conducive to reduced dissolved oxygen conditions. Such a situation occurred in 1967, when drawdown contributed to reduced dissolved oxygen levels to the point that a severe winterkill was experienced (lake level at elevation 1593.6).

2.86 Under existing conditions, maximum water levels behind Lake Darling Dam are about 1599 and 1601 for the 25- and 50-year events, respectively. Following a flood event, the pool is drawn down to 1596 to provide some degree of flood protection for summer storm events.

Corps of Engineers

2.87 Minot Channel Project: The Minot channel project, authorized as a separate feature of the Souris River flood control plan, was approved by the Senate and House Public Works Committee resolutions adopted 25 June and 14 July 1970, respectively. The channel project involved increasing the capacity of the existing channel from 1,500 cfs to 5,000 cfs from Burlington through Minot and to 3,000 cfs from downstream of Minot to Velva, North Dakota. At present, the Minot channel project is about 80 percent complete.

2.88 It is estimated that Minot would be protected from about a 300-year flood event originating from Gassman Coulee and uncontrolled drainages below the proposed Burlington Dam, from about a 250-year event originating on the Des Lacs River, and from about a 20-year event on the Upper Souris River. Considering all sources above Minot, the city could expect a flood that would exceed 5,000 cfs on the average of once every 20 years.

2.89 Other than the Minot channel project the only other flood control project in the Souris River basin by the Corps of Engineers involves local protection works, together with snagging and clearing of the Souris River at Velva for flash floods originating on Bonnes Coulee. These works were approved 25 June 1965 by the Chief of Engineers for construction under the continuing authority of section 205 of the 1948 Flood Control Act, as amended. The protective works were completed in 1968 at a total cost of about $308,100.

2.90 The project includes a levee between the coulee and Velva from the south bluff of the Souris River valley to the Soo Line Railroad embankment near the river, a ramp at the U.S. Highway 52 levee crossing, enlarged waterway openings through the U.S. Highway 52 and Soo Line Railroad embankments, limited channel enlargement on Bonnes Coulee, and snagging and clearing along Bonnes Coulee below the enlarged channel and along the Souris River through and below Velva.

U.S. Bureau of Reclamation

2.91 The authorized plan for the Garrison Diversion unit of the Missouri River basin project provides for diversion by the U.S. Bureau of Reclamation of water from the Missouri River above Garrison Dam for the irrigation of about 116,000 acres in the Souris River basin and an additional 134,000 acres in the Sheyenne River and James River basins. The project also provides for restoring historic levels of Devils Lake and Stump Lake, supplementing low flows in the Red River of the North as well as in the above-mentioned streams, and augmenting water supplies of about 14 municipalities and four industrial areas. A final environmental statement (INT FES 74-3) was filed with the Council on Environmental Quality on 10 January 1974. The statement is now being rewritten.

2.92 A system of canals and pumping stations would discharge water required for irrigation into Lonetree Reservoir (maximum operating pool, elevation 1640). The Souris River basin would be supplied by the Velva Canal (reach 1 capacity of 2,000 cfs and reach 3 capacity of 160 cfs), which would head at the Wintering Dam on Lonetree Reservoir and extend northwesterly a straight-line distance of about 84 miles through the central part of the Souris River loop. The Deep River and its tributaries would collect irrigation return flows and convey these flows into the Souris River.

2.93 The region in the Souris River basin being considered for irrigation consists mainly of the area in McHenry County between the Velva Canal and the Souris River and also includes a 12,200-acre area near Karlsruhe. Siphons would be provided where the canals cross stream valleys, and some of the tributaries joining the Souris River below Verendrye would convey return flows into the Souris River.

2.94 Construction of an interim water supply system for the city of Minot is currently underway by the Bureau of Reclamation. The completion of the ultimate supply, taking the water from the Velva Canal, is scheduled about 20 years hence.

U.S. Soil Conservation Service

2.95 In April 1963 the U.S. Soil Conservation Service initiated planning for flood control in the Boundary Creek watershed, tributary to the Souris River in north-central Bottineau County. Projects authorized for installation within this watershed include two small retarding dams in the upper watershed, with flood storage capacities of 2,250 and 3,720 acre-feet, and extensive channel modification downstream from these structures. These modifications would have no significant effect on Souris River flood flows.

North Dakota State Water Commission

2.96 The Tolley Flats area of Ward and Renville Counties, North Dakota, is part of a 200 square mile upland region between the Des Lacs and Souris Rivers which drains toward Tolley, North Dakota, and has no natural outlet. The water management districts of both Ward and Renville Counties have requested the North Dakota State Water Commission to develop a plan to relieve flooding in the Tolley Flats area. The current provisional proposal, North Dakota State Water Commission Project No. 626, involves the construction of 11.8 miles of channel and a small dam on Mackobee Coulee to trap sediment and regulate flows into Lake Darling. This project, which has no relationship to the proposed Burlington flood control project, is being held up primarily because of the lack of local financial capability.

Water Resource Projects by Others

2.97 Canadian and private interests and local governmental entities have also constructed low-head dams on the Souris River and its tributaries in the interest of irrigation, recreation, stock watering, and domestic and industrial water supply. The reservoirs, however, are small and are not factors in the flood problems of the basin. The reservoir created by Boundary Dam on Long Creek near its confluence with the Souris River in Saskatchewan, for example, impounds 48,800 acre-feet of water for power production and municipal water supply for Estevan, Saskatchewan, but, since it is normally maintained as full as possible, provides only limited local flood protection. In 1972 the Saskatchewan Nelson Basin Board made a preliminary invesigation of a 600,000 acre-foot reservoir (Rafferty Dam) on the main stem of the Souris River near Estevan. The purpose of the

reservoir would be to supplement low flows along the Souris River for irrigation and municipal and industrial water supply. It also could provide up to 300,000 acre-feet of flood control storage. The plan also involved diversion of the Qu' Appelle River into the Upper Souris River, and a 3,500 cfs diversion channel from the Upper Souris River to the Lower Souris River just north of the international boundary. However, there was no commitment to the Souris project or others investigated. In the Canadian portion of the Souris basin there seems to be more interest in water supply than in flood control, which is the opposite of the interest in the Burlington Phase I GDM study. The various Canadian water resource options are currently being restudied, this time over the entire basin by the Canadian Souris River Basin Study Board. The Board report will outline the water resources problems in Saskatchewan and Manitoba, plus the options to solve the problems. Any large-scale construction would be a number of years away.

2.98 Two active irrigation projects are located in the basin: the Eaton Flood Irrigation project on the Souris River near Towner, and the Judge A. M. Christianson project on the Souris and Des Lacs Rivers near Burlington. The Eaton project includes a low-head dam in a reach of the river where the banks are only slightly higher than the adjoining level hay lands, facilitiating the regulated spring flooding of these hay lands to increase yields. The Judge A. M. Christianson project includes two low-head dams on the Des Lacs River, one low-head dam on the Souris River, and a network of irrigation ditches. This system irrigates small tracts of small grains and vegetables.

VEGETATION

2.99 The United States portion of the Souris River basin is located within the Temperate North American Grasslands Biome (Odum, 1971) in which rolling grasslands are the most prominent and extensive form of vegetation. According to Kuchler (1964) the following, more specific types of potential natural vegetation are recognizable in the area of study.

a. Wheatgrass-Bluestem-Needlegrass(1) which takes the form of dense, medium-to-tall grassland.

b. Oak Savannah as taller, denser grassland with scattered deciduous trees and brush (often recognizable also as the uppermost extension of the floodplain forest at the heads of coulees and sub-valleys).

c. Aspen Parkland which represents a transitional zone between the grasslands and the boreal forests to the north.

(1) Wheatgrass-Needlegrass, generally to the west of the study area, has a less dense and somewhat shorter form than the above (consistent with decreasing average annual rainfall along the east to west gradient), and is not considered here.

[illegible]. Northern Floodplain Forest in which the dominant form of vegetation is large deciduous trees such as willow, cottonwood, and elm and in which the understory varies from open, sparse herbs to dense shrubs and young saplings of the dominant tree species.

2.100 Of the major kinds of terrestrial biological systems considered in this report, the woodlands are the smallest in total area. North Dakota ranks last of the 50 States in total acres of woodlands, with [illegible],000 total acres of forests (about 2 percent of the State land area as compared with 35 percent, for example, for the State of Minnesota) (Lunan, et al., 1973). This is because of prairie fires, climate, and soil factors which tend to favor grassland in the area.

2.101 In addition to the terrestrial systems listed above, a number of aquatic and semiaquatic biological systems are generally recognized as follows:

a. The various kinds of wetlands or marshes which occur as natural prairie potholes of glacial origin in the upland drift prairie; natural oxbow cutoffs in the river valleys; the smaller impoundments of the USFWS; and "dug-outs" which have been created on agricultural lands for stock watering, mostly under cost-sharing programs with the U.S. Soil Conservation Service.

b. Open, standing waters consisting primarily of the larger USFWS impoundments as discussed under the section on Existing and Authorized Water Resource Projects, but also including the larger natural oxbow cutoffs along the rivers, as well as Buffalo Lodge Lake near Granville.

c. Flowing waters of the Souris and Des Lacs channels and their tributaries in which the most prominant forms of plant and animal life are algae, aquatic invertebrates, and small fish such as darters.

2.102 The more detailed discussion (including some acreage estimates) to follow is based in part on an environmental study of some of the flood control alternatives for the Souris and Des Lacs Rivers (Lunan, et al., 1973). Much of the rest of the discussion is based on staff observations or work of the USFWS (especially the recent acreage estimates in table 5, page 49).

Grasslands

2.103 Grasslands may be defined as herb-dominated communities on which the water table is well below the root crown by 15 June. This land may be flooded in early spring but not for a long enough period

Table 5. Acreages of Habitat Types Between Burlington Dam and the Saskatchewan Border Based on 1975 Aerial Photos and Supplied by the USFWS

			Acres			
Evaluation Segment[1/]	Frequency of Inundation[7/]	Elevation Contour Interval	Bottomland Hardwood[2/]	Marsh[3/]	Agricultural Land[4/]	Grassland[5/]
	2	1590-1600[6/]	60	491	0	160
I	50	1600-1610	589	135	1133	766
	1000	1610-1620	241	250	779	391
		Total	890	876	1912	1317
	2	1590-1600[5/]	6	1009	19	129
II	50	1600-1610	4	49	106	1028
	1000	1610-1620	13	0	32	779
		Total	23	1058	157	1936
	55	1575-1580	85	1250	50	25
	65	1580-1585	100	385	100	50
	70	1585-1590	40	-	145	150
	73	1590-1595	-	-	75	120
III	83	1595-1660	-	-	25	112
	120	1660-1605	-	-	34	130
	180	1605-1610	-	-	25	145
	450	1610-1615	-	-	35	75
	1500	1615-1620	-	-	20	115
		Total	225	1635	509	992
	50	1565-1570	175	250	-	-
	50	1570-1575	52	216	782	240
	55	1575-1580	-	-	264	150
	65	1580-1585	-	-	-	106
	70	1585-1590	-	-	-	90
IV	73	1590-1595	-	-	-	133
	83	1595-1600	-	-	-	67
	120	1600-1605	-	-	-	80
	180	1605-1610	-	-	-	45
	450	1610-1615	-	-	-	120
	1500	1615-1620	-	-	-	115
		Total	227	466	1046	1146

1/ Segment I: Saskatchewan to upper limit of Lake Darling
Segment II: Upper limit of Lake Darling to Lake Darling Dam
Segment III: Lake Darling Dam to Baker Bridge (downstream boundary of Upper Souris NWR)
Segment IV: Baker Bridge to Burlington Dam

2/ Wooded areas in coulees were included under grassland because of small individual acreages

3/ Includes fringe of emergent vegetation around Lake Darling and along river channel

4/ Includes cultivated areas, alfalfa, bare ground, and cultural features

5/ Includes native and tame grassland, pasture shrubs, and prairie shrubs (wooded coulees)

6/ Spillway level of existing Lake Darling is 1598 while normal operating pool is 1596

7/ Frequency of inundation at mid-point of Elevation Contour Interval, i.e., elevation 1595 would be inundated every two years.

to alter plant composition. The grasslands of the Souris region are dominated in general by western wheatgrass, big bluestem, and needle-grass. The present condition of grasslands, which are commonly heavily grazed, and records from the General Land Office Survey indicating presettlement conditions, confirm Kuchler's(1964) analysis of the potential vegetation of the Souris loop. However, much of the grassland has been converted to tame and wild hay or small grain crops. Inside refuge boundaries grassland is maintained for wildlife. However, farming and cattle grazing on some of the refuge lands (when compatible) are permitted by the USFWS. Considering both private and Federal holdings, grasslands account for about 15 percent of the land area in the Souris and Des Lacs floodplains and roughly 20 percent of the United States portion of the basin. (Lunan, et al., 1973).

2.104 The species composition of this community type was determined as a part of the Minot State College study (Lunan, et al., 1973), and the reader is referred to that report for a more thorough discussion.

2.105 Untilled grasslands in the floodplain and on valley slopes are usually pastured heavily. When in good condition, pastured grassland is dominated by prairie sand reed grass, blue grama grass, and sedges, while the more moist sites are generally characterized by prairie cordgrass, northern reed grass, and sedges. These intergrade on slopes and are associated with varying numbers of asters, sunflowers, and other forbs (herbaceous plants other than grasses). Poor or overgrazed pasture is heavily invaded by green sage, white sage, and fringed sage; and leafy spurge is becoming a dominant nuisance weed. In areas that have been seeded, brome grass and Kentucky bluegrass are common, and some rangelands, especially on the flood-plain, are being converted to alfalfa.

2.106 The primary cultural uses of the grasslands have been for agriculture and recreation. Crop production occurs on the flat valley bottoms. The clay to clay-loam soils of the grassland have a fairly high water-holding capacity and limited porosity. (North Dakota Agricultural Experiment Station, 1968). With the limited precipitation of this region, these soil types facilitate holding available water, making the area good for small grain production. These grains are important economically to the people in the Souris and Des Lacs River valleys, where in 1972 there were approximately 3,950 acres of small grain cropland. The relatively protected river valleys also provide grazing. Pasture land has been overgrazed, and the stocking rate for cattle should be limited to maintain long-range productivity. The U.S. Soil Conservation Service presently recommends stocking at the rate of 6 to 12 acres of pasture per cow.

Oak Savannah and Aspen Parkland

2.107 In the sand hills southwest of Towner, big bluestem, little bluestem, and bur oak are dominant, with the oak scattered singly or in groves. This sand-hill savannah community type extends from southwest of Towner north to the J. Clark Salyer National Wildlife Refuge. Aspen parkland communities are also found in this area including, but not restricted to, the Mouse River State Forest near Towner.

Floodplain Forest

2.108 In terms of acreage, the floodplain forest is the smallest community in the Souris loop. However, the floodplain forest, particularly in North Dakota, is an important community. North Dakota, while a large State, ranks 50th out of the 50 States in total acres of woodland with about 400,000 acres of forest community. The 7,950 acres of forest in the Souris River between the Saskatchewan border and the upstream boundary of the J. Clark Salyer National Wildlife Refuge represent about 2 percent of North Dakota's forest. Much of North Dakota's forest is concentrated in the Turtle Mountain and Pembina Hills. Excluding those areas, the woodlands of the Souris loop constitute about 7 percent of the State's forest acreage (Lunan, et al., 1973). Woodlands have increased in some local areas due to the supression of fires and due to the planting of field and farmstead shelterbelts, but on a Statewide basis have decreased due to clearing for agriculture and development.

2.109 Several floodplain forest transects were taken at various points along the Souris River as part of the study by Minot State College in order to ascertain which species were present and to gather quantitative biological data on the major woody vegetation. Since many of the forbs had flowered, set seed, and died before the time of year that the study was initiated, the transect observations were augmented by the work of Weaver (1968), Lautenschlager (1964), and Wanek (1967). Tree and shrub composition was studied quantitatively by Wanek for the Red River, and Disrud (1972) has collected data from the Souris River valley. Some floodplain forest data are given in table 6.

TABLE 6

Relative density, relative dominance, relative frequency, and importance value of selected floodplain forest tree species[1]

Species	Oak Park, Minot				Burlington, ND
	Relative density	Relative dominance	Relative frequency	I.V.[2]	I.V.[2]
Green Ash (*Fraxinus pennsylvanica*)	45	33	41	119	98
American Elm (*Ulmus americana*)	32	46	41	110	152
Bur Oak (*Quercus macrocarpa*)	5	8	8	21	0
Box Elder (*Acer negundo*)	15	12	16	43	51
Cherry (*Prunus* sp.)	3	1	2	6	-

(1) From Dunan, *et al*. (1973).

(2) I.V. (Importance Value) = relative frequency + relative density + relative dominance.

2.110 The Northern Floodplain Forest system along the Souris and Des Lacs Rivers usually consists of a thin belt (up to about one-half mile wide in places) connecting intermittent (usually) 1- to 25-acre wooded patches which are generally located within oxbow meanders. The woodland is often dominated above and below Burlington by elm, green ash, and box elder, with bur oak entering the species composition below Burlington. In Oak Park at Minot, aging of oaks and elms indicates an age for oaks of around 120 years; elms of 35 to 40 inches in diameter reach an age of 170 to 180 years when occupying well drained sites. Bur oak seems to be reaching the edge of its range in this area. New tree reproduction consists mostly of willow, cottonwood, box elder, and ash. Where the canopy is open, many shrubs can be found, but where the canopy is dense and the woodland is not grazed, the understory consists mainly of sedges, scattered forbs such as meadow rue and violets, and dogwood and other shrubs. On the forest edges shrubs are more profuse and may include hawthorn, chokecherry, wolfberry, and roses.

2.111 The majority of the river bottom woodland is confined to the primary floodplain. However, a somewhat similar forest community also is developed in the deeper coulees on east-facing slopes. These coulees, which tend to be dominated by bur oak, are drier than river bottom forests but nonetheless provide valuable deer browse.

Wetlands

2.112 Marsh and higher-order wetland habitats may be defined as those areas having some standing water until at least mid-July, followed by variable periods of wetness, and dominated by emergent semiaquatic vegetation such as cattails and rushes. Wetlands vary in many characteristics, most notably depth and permanence of water, qualitative and quantitative aspects of vegetation, and wildlife production potential.

2.113 Attrition of wetlands has been steady as a result of private and Government-sponsored drainage programs, filling for highways, housing and industrial developments, and other causes. Of an estimated 127 million acres of wetlands present in colonial times in the continental United States, more than 45 million acres have been converted to dry land use (Linduska, 1964). Some 371,000 acres of wetlands of value to waterfowl were drained from 1943 through 1962 in North Dakota. An estimated 6 percent (85,000 acres) of the permanent and semipermanent wetlands which existed in 1964 in North Dakota had been drained by 1972. In the same period, losses in Minnesota were estimated at 20 percent.

2.114 Location. There are approximately 1,500 acres of wetlands located between the Saskatchewan border and the Lake Darling Dam (including the vegetated fringe around Lake Darling) and approximately 3,600 acres of natural and managed marsh located between the Lake Darling Dam and the site of the proposed Burlington Dam.

2.115 Value to Man. Wetlands are valuable for producing wildlife, particularly fish, waterfowl, and furbearers, that contribute both aesthetically and economically to the nations well-being. The prairie pothole region of the northern plains has long been recognized as the nation's "duck factory," producing a large percentage of the ducks on the North American continent (Smith 1974).

2.116 The major recreational activities that draw people to the wetland resource are hunting and fishing. Photographers and bird-watchers are also utilizing wetlands in increasing numbers. Trapping furbearers in wetland areas is an important source of livelihood for a few and a supplemental income for many others (U.S. Dept. of Interior, 1967).

2.117 Wetlands play a major role in the hydrologic cycle by storing and replenishing groundwater supplies that are essential to cultural, domestic, and industrial needs. Goodwin and Niering in Smith (1974) identified wetlands as performing a significant role in the filtration of pollutants as well as identifying their usefulness for educational and recreational purposes. Wenck (1977) found that a wetland area studied in Minnesota removed 77 percent of the phosphates and 94 percent of the total suspended solids entering as urban stormwater runoff.

2.118 Threatened and Endangered Plants. The Federal Register of 16 July 1976 has been consulted. No known species of threatened or endangered plants exist within the project area.

WILDLIFE AND RELATED RESOURCES OF THE SOURIS REFUGES AND SOURIS LOOP

2.119 This section presents information on wildlife populations in the general area of project impact. Since relatively good wildlife population data are available for the two Souris River National Wildlife Refuges (NWR's), since the NWR's contain perhaps the key wildlife habitat along the Souris River, and since the NWR's are of key environmental concern, the refuges are emphasized in this discussion. This section also discusses other, miscellaneous refuge products except for fisheries and vegetation which are discussed elsewhere.

Upper Souris NWR

2.120 The Upper Souris NWR has a primary function in production of huntable waterfowl, provision for other necessities in the life cycle of waterfowl, and water supply to J. Clark Salyer NWR (through assured releases from Lake Darling). As with all NWR's, the refuge provides many other benefits to the public; in this case, upland and big game, fur bearers, nongame species, public use of refuge related resources, some haying and grazing, and prevention of waterfowl depredations on private lands.

2.121 Table 7 presents data on estimated production, peak populations, and waterfowl use-days for "huntable" species, as taken from the Upper Souris NWR wildlife use report for Fiscal Year 1976. "Huntable" should be taken advisedly because recent seasons on some species such as canvasback have been curtailed, while some of the species listed in table 8 under "nongame" species are hunted in other areas.

TABLE 7

WATERFOWL USE AND PRODUCTION ON UPPER SOURIS NWR

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	APR-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
American Coot	552,000	108,600	300	78,000	738,900	11,000	08/30	650
Whistling Swan	600	19,050	90	2,550	22,290	550	11/25	0
Snow Goose	0	960,000	0	0	960,000	20,000	11/10	0
White-Fronted Goose	9,450	51,000	0	2,250	62,700	1,800	10/20	0
Canada Goose	23,550	92,550	5,310	25,650	147,060	4,000	10/30	58
Common Merganser	0	0	0	1,350	1,350	85	04/10	0
Hooded Merganser	750	450	0	150	1,350	35	10/30	0
Mallard	427,800	258,300	7,500	62,250	755,850	5,800	09/25	580
Black Duck	450	150	0	300	900	5	07/25	0
Gadwall	194,400	75,000	0	34,650	304,050	2,475	09/25	449
American Wigeon	141,300	31,500	0	26,850	199,650	1,700	07/30	200
Green-Winged Teal	10,800	5,250	0	2,700	18,750	250	10/10	84
Blue-Winged Teal	128,700	16,050	0	64,200	208,950	2,200	07/25	1370
Northern Shoveler	172,650	202,650	150	37,800	413,250	6,000	10/30	265
Pintail	71,250	61,500	2,250	29,400	164,400	2,100	10/25	316
Wood Duck	3,750	1,350	0	1,950	7,050	55	10/15	4
Redhead	36,750	35,550	300	5,100	77,700	1,400	10/10	23
Canvasback	111,450	103,500	0	111,000	226,050	3,500	10/15	31
Lesser Scaup	21,600	108,000	900	65,100	195,600	3,200	10/10	15
Ringed-Necked Buck	2,850	1,050	0	750	4,650	40	07/10	0
Common Goldeneye	4,050	3,900	0	2,250	10,200	300	10/15	0
Bufflehead	7,500	18,600	0	3,750	29,850	500	10/10	0
Ruddy Duck	221,550	300,000	0	4,500	526,050	12,000	10/15	25

2.122 Several observations are in order. First, data are presented for the whole refuge and not by contour or segment, e.g., above and below Lake Darling. This does not allow direct comparison with the "habitat unit" analysis in the mitigation study, but was done because the data are presented for the whole refuge in the wildlife use reports. Further breakdown would involve a further level of estimating not supported by field data. However, some observations made in 1976 can help to interpret the data; these are (note that conclusions will change somewhat with management over the years):

1. Goose roosting was most heavy in a pool in rotational drawdown just below Lake Darling with production of Canadas scattered along the refuge below Lake Darling. Goose foraging areas depend upon management of grazing areas.

2. Puddle duck usage seemed most heavy below Lake Darling.

3. Tree-nesting ducks were commonly found above and below Lake Darling.

4. Diving ducks with behaviors like the redhead were most common in Lake Darling or pools below the lake which had recently undergone drawdown and reflooding. The more strictly open-water ducks like the ruddy duck were fairly much restricted to Lake Darling.

2.123 Secondly, waterfowl use of the Upper Souris NWR is important even when it is not in the form of direct production of birds for local human use. The reason is that the refuge is essential in varying degrees to sustaining waterfowl use and hunting in other areas. Therefore, the refuge is an integral, though indirect, part of production through its function for males-in-waiting, moulting, staging, migration, etc. (For further information on refuge benefits to hunting in other areas, see the discussion of waterfowl impacts in section 4).

2.124 Third, regionally unique contributions of the Upper Souris NWR to huntable waterfowl are of considerable interest. The most important such contribution is through Upper Souris NWR's water supply support to J. Clark Salyer in that refuge's operation. Sustained Souris River flows from Lake Darling also sustain a higher production along the rest of the Souris River than would otherwise be the case.

2.125 Fourth, noting of trends is in order, although accurate prediction over the next 100 years is not possible. Pertinent trends are:

1. Canada goose production is increasingly encouraged by provision of nesting structures (and the general management efforts toward provision of goose grazing).

2. Waterfowl habitat in North Dakota continues to shrink due to private and governmental actions. Remaining habitat on the refuge should therefore become more important.

3. Public use, both consumptive and nonconsumptive, exerts greater demand upon a diminishing resource. An increasing scarcity factor thus exists.

2.126 Table 8 presents data on the use of the Upper Souris NWR by the larger "nongame" avian species. Pertinent observations on table 8 are:

1. The area of the project and potential mitigation sites is suited to supplemental mitigatory efforts, such as providing scattered plantings of clumps of trees for nesting of prairie raptors. The mitigation and benefit/cost analyses do not include these supplemental measures.

2. The data may more completely record unusual sightings, e.g., of eagles.

3. Management of nongame wildlife is not specifically provided for, due to severe restrictions on refuge development and maintenance funds in recent years (effects also include game species). Nevertheless, nonconsumptive use of nongame species in significant amounts results from the refuge. A general indication of the monetary value of nonconsumptive use of all wildlife can be gathered from studies like Horvath (1974), which estimated nonconsumptive value to be 1.5 times consumptive value.

4. Without the refuge, some of the species, e.g., Western grebes, would be very rare or absent in the area.

2.127 Table 8A presents data on the use of the Upper Souris NWR by upland game, big game, and furbearers. Pertinent observations on this table are:

1. Upland game hunting is not allowed on the Upper Souris NWR although the refuge supports this activity through its function as a breeding reservoir and as winter and escape cover.

TABLE 8

USE OF UPPER SOURIS NWR BY THE LARGER NONGAME AVIAN SPECIES

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	ARP-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
Western Grebe	35,100	2,700	0	23,000	60,800	400	07/31	0
Horned Grebe	3,230	0	0	2,000	5,230	40	07/31	0
Eared Grebe	14,600	50	0	10,000	24,650	175	07/31	0
Pied-Billed Grebe	19,040	300	0	10,800	30,140	220	07/31	0
Common Loon	*	*	*	*	*	*	*	*
Ring-Billed Gull	18,400	4,000	0	153,000	175,400	8,000	05/15	0
Franklin's Gull	9,200	200	0	120,500	129,900	4,500	05/25	0
Double-Crested Cormorant	57,250	750	0	36,600	94,600	650	07/31	0
White Pelican	50,700	0	0	45,600	96,300	600	07/31	0
American Bittern	3,070	0	0	2,100	5,170	35	07/31	0
Great Blue Heron	10,540	375	0	9,000	19,915	127	07/31	0
Lesser Sandhill Crane	0	100	0	625	725	125	04/15	0
American Avocet	18,000	375	0	7,000	25,375	225	08/15	0
Common Snipe	150	10	0	1,725	1,885	25	04/25	0
Willet	9,200	50	0	9,600	18,850	300	06/05	0
Killdeer	6,000	150	0	8,750	14,900	125	06/30	0
Marsh Hawk	550	0	0	1,365	1,915	20	05/10	0
Swainson's Hawk	0	0	0	420	420	12	05/20	0
Golden Eagle	0	60	5	30	95	6	11/25	0
Bald Eagle	5	15	0	15	35	3	10/25	0
Short-Eared Owl	20	15	0	0	35	3	11/05	0
Great-Horned Owl	540	720	546	891	2,697	9	06/15	0
Snowy Owl	0	5	0	0	5	1	11/08	0

***Figures were not available**

TABLE 8A

UPLAND GAME, BIG GAME, AND FURBEARERS ON UPPER SOURIS NWR

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	APR-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
Upland Game Birds								
Gray Partridge	*	*	*	*	54,750	150	06/20	0
Sharp-Tailed Grouse	*	*	*	*	306,000	1,150	06/25	350
Ring-Necked Pheasant	*	*	*	*	98,250	350	06/25	100
Mammals								
White-Tailed Jackrabbit	*	*	*	*	*	*	*	*
Beaver	*	*	*	*	80,300	220	06/30	0
Muskrat	*	*	*	*	100,375	275	06/30	0
Coyote	*	*	*	*	4,380	12	06/30	0
Red Fox	*	*	*	*	25,550	70	06/30	0
Raccoon	*	*	*	*	45,625	125	06/30	0
Weasel	*	*	*	*	*	*	*	*
Mink	*	*	*	*	36,500	100	06/30	0
Badger	*	*	*	*	*	*	*	*
Skunk	*	*	*	*	*	*	*	*
White-Tailed Deer	*	*	*	*	133,500	370	06/30	65

*Figures were not available

2. There is a significant amount of big game hunting on the refuge. The refuge also provides over-winter cover for deer from the surrounding area. The data in the table are very conservative as to big game dependence on the refuge because they do not include peak use during severe winters.

2.128 J. Clark Salyer NWR, which is larger than Upper Souris NWR, is similar in function (and other amenities provided) to Upper Souris except, of course, that it does not function in supplying water to refuges. Table 9 presents data on estimated production, peak populations, and waterfowl use-days for "huntable" species as taken from the FY 76 wildlife use report. Table 10 has data on the larger "nongame" avian species, and Table 10a on upland game, big game, and furbearers. The more general observations made in the discussion of Upper Souris NWR wildlife data also apply in large part to J. Clark Salyer. Botulism is occasionally a problem at J. Clark Salyer, as was the case in the summer of 1977.

2.129 Data on acreage of wildlife habitat subject to inundation by the Burlington Dam floodpool are presented in table 5.

Other Reaches of the Souris Valley

2.130 There is also considerable habitat in non-refuge reaches of the Souris valley. Waterfowl, beaver, mink, and muskrat have a significant amount of habitat available along the 179 river miles between the refuges (exclusive of 8 river miles in Minot) and the 26 river miles between Upper Souris NWR and the Saskatchewan border. Much of this habitat has been degraded by Corps snagging and clearing (about 17.1 river miles for the Minot project and an additional amount at Velva), scattered development, and other factors, but the large lineal amount, plus the quality of reaches of good habitat, combine to make this area a significant producer of these semiaquatic wildlife.

2.131 Among the semiaquatic species, only for waterfowl are there population density data which are readily available and considered to be reliable. The International Garrison Diversion Study Board (IGDSB) (1976:20) extrapolated from Stewart and Kantrud (1973) to a riverine population estimate of eight waterfowl breeding pairs per unmanaged river mile. A production excess of 1.08 fledged young per adult in unmanaged portions of the river was obtained by the IGDSB from the flyway 8-year production ratios (USFWS, 1964-1975). Applying this production estimate to the 205 miles of unmanaged river in the Burlington Dam reach of impact gives an annual estimated waterfowl production of about 6,800 fledged young.

TABLE 9
WATERFOWL USE AND PRODUCTION ON J. CLARK SALYER NWR

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	APR-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
American Coot	1,620,000	570,000	0	1,110,000	3,300,000	35,000	04/30	0
Whistling Swan	300	18,000	0	33,000	51,300	1,500	04/01	0
Snow Goose	15,000	2,400,000	0	450,000	2,865,000	100,000	10/01	0
White-Fronted Goose	30,750	15,000	0	39,000	84,750	10,000	10/01	0
Canada Goose	0	0	0	45,000	45,000	1,500	05/30	0
Hooded Merganser	0	0	0	0	0	0	-	0
Common Merganser	0	0	0	6,000	6,000	300	04/11	0
Mallard	840,000	1,200,000	6,000	570,000	2,616,000	50,000	10/30	6,744
Black Duck	4,500	2,250	0	300	7,050	100	09/01	0
Gadwall	420,000	165,000	0	420,000	1,005,000	7,000	10/30	3,680
American Wigeon	210,000	165,000	0	195,000	570,000	7,000	10/30	5,353
Green-Winged Teal	4,500	3,000	0	54,000	61,500	1,000	04/30	6,078
Blue-Winged Teal	570,000	60,000	0	765,000	1,395,000	15,000	04/30	5,911
Northern Shoveler	270,000	61,500	0	390,000	721,500	8,000	05/30	7,417
Pintail	570,000	322,500	3,000	600,000	1,495,500	20,000	10/30	9,090
Wood Duck	24,000	2,250	0	25,500	51,750	500	05/30	100
Redhead	90,000	22,500	0	75,000	187,500	2,000	09/30	3,500
Canvasback	34,500	30,000	0	37,500	102,000	1,000	10/30	2,492
Lesser Scaup	60,000	120,000	0	723,000	903,000	16,000	04/30	1,000
Ring-Necked Duck	7,500	1,800	0	21,000	30,300	700	05/30	500
Common Goldeneye	0	0	0	6,000	6,000	400	04/10	0
Bufflehead	1,500	4,500	0	4,800	10,800	250	11/30	100
Ruddy Duck	75,000	6,000	0	36,000	117,000	2,000	06/30	4,000

***The hooded merganser occasionally nests within the J. Clark Salyer NWR; however, no nesting was observed during FY76.**

TABLE 10
USE OF J. CLARK SALYER NWR BY THE LARGER NONGAME AVIAN SPECIES

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	APR-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
Western Grebe	6,000	500	0	25,000	31,500	500	06/01	0
Horned Grebe	90,000	5,000	0	25,000	120,000	1,000	09/15	0
Eared Grebe	90,000	5,000	0	150,000	245,000	3,000	06/01	0
Pied-Billed Grebe	45,000	2,500	0	100,000	147,500	2,000	06/01	0
Herring Gull	45,000	2,500	0	1,000	48,500	500	09/30	0
Ring-Billed Gull	45,000	2,500	0	5,000	52,500	500	09/30	0
Franklin's Gull	1,350,000	75,000	0	500,000	1,925,000	15,000	09/30	0
Common Tern	90,000	5,000	0	25,000	120,000	1,000	09/30	0
Black Tern	90,000	5,000	0	15,000	110,000	1,000	09/30	0
Double-Crested Cormorant	9,000	500	0	50,000	59,500	1,000	06/01	0
White Pelican	45,000	2,500	0	7,500	55,000	500	09/15	0
American Bittern	45,000	2,500	0	50,000	97,500	1,000	06/01	0
Great Blue Heron	9,000	500	0	5,000	14,500	100	09/15	0
Cattle Egret	8,000	500	0	10,000	18,500	200	06/01	0
Black-Crowned Night Heron	90,000	5,000	0	100,000	195,000	2,000	06/01	0
Lesser Sandhill Crane	0	0	0	100	100	10	06/01	0
Greater Sandhill Crane	1,000	500	0	0	1,500	100	09/15	0
Virginia Rail	0	0	0	1,000	1,000	20	06/01	0
Sora	9,000	500	0	50,000	59,500	1,000	06/01	0
Wilson's Phalarope	1,800	100	0	50,000	51,900	1,000	05/30	0
American Avocet	45,000	2,500	0	10,000	57,500	500	09/30	0
Common Snipe	18,000	10,000	0	10,000	38,000	2,000	09/30	0
Long-Billed Dowitcher	900	50	0	1,000	1,950	50	05/15	0
Pectoral Sandpiper	900	50	0	0	950	10	09/30	0
Baird's Sandpiper	4,500	250	0	0	4,750	50	09/30	0
Least Sandpiper	4,500	250	0	0	4,750	50	09/30	0
Semipalmated Sandpiper	1,800	0	0	0	1,800	20	09/30	0

TABLE 10 (CONTD)
USE OF J. CLARK SALYER NWR BY THE LARGER NONGAME AVIAN SPECIES

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	APR-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
Marbled Godwit	9,000	500	0	25,000	34,500	500	05/30	0
Hudsonian Godwit	1,800	100	0	4,000	5,900	200	05/15	0
Greater Yellowlegs	90,000	5,000	0	50,000	145,000	1,000	09/30	0
Lesser Yellowlegs	90,000	5,000	0	75,000	170,000	1,500	06/15	0
Solitary Sandpiper	900	50	0	2,000	2,950	100	05/15	0
Willet	45,000	2,500	0	25,000	72,500	500	09/30	0
Upland (Plover) Sandpiper	45,000	2,500	0	50,000	97,500	1,000	06/15	0
Spotted Sandpiper	1,800	100	0	1,000	2,900	50	05/15	0
Black-Bellied Plover	1,800	100	0	1,000	2,900	50	05/15	0
American Golden Plover	4,500	250	0	1,000	5,750	50	09/30	0
Killdeer	45,000	2,500	50	50,000	97,550	1,000	06/15	0
Semipalmated Plover	1,800	100	0	2,000	3,900	100	05/15	0
Ruddy Turnstone	4,500	250	0	1,000	5,750	50	09/30	0
Mourning Dove	*	*	*	*	600,000	4,000	09/01	0
Marsh Hawk	8,000	5,000	150	4,500	17,650	100	09/30	0
Red-Tailed (Harlan) Hawk	8,000	1,000	0	4,500	13,500	100	09/30	0
Swainson's Hawk	2,000	250	50	4,500	6,800	50	05/01	0
Rough-Legged Hawk	4,000	500	0	2,250	6,750	50	09/30	0
Golden Eagle	0	100	50	180	330	5	11/24	0
Bald Eagle	0	100	50	360	510	5	11/24	0
American Kestrel (Sparrow Hawk)	4,000	500	0	9,000	13,500	100	05/01	0
Short-Eared Owl	2,000	250	0	4,500	6,750	50	05/01	0
Great Horned Owl	4,000	4,000	0	2,250	10,250	50	09/30	0
Snowy Owl	0	500	300	0	800	10	12/15	0

*Data were not available

TABLE 10a
UPLAND GAME, BIG GAME, AND FURBEARERS ON J. CLARK SALYER NWR

SPECIES	USE DAYS JUL-SEP 75	OCT-DEC 75	JAN-MAR 76	APR-JUN 76	FY TOTAL	PEAK POPULATION	DATE OF PEAK	NUMBER PRODUCED
Upland Game Birds	*	*	*	*	72,000	200	09/01	**
Gray Partridge	*	*	*	*	270,000	750	09/01	**
Sharp-Tailed Grouse	*	*	*	*	144,000	400	09/01	**
Ring-Necked Pheasant								
Mammals	*	*	*	*	175,000	500	09/01	**
White-Tailed Jackrabbit	*	*	*	*	175,000	500	09/01	**
Beaver	*	*	*	*	1,750,000	5,000	09/01	**
Muskrat	*	*	*	*	17,500	50	09/01	**
Coyote	*	*	*	*	175,000	500	09/01	**
Red Fox	*	*	*	*	350,000	1,000	09/01	**
Raccoon	*	*	*	*	175,000	500	09/01	**
Weasel	*	*	*	*	245,000	700	09/01	**
Mink	*	*	*	*	35,000	100	09/01	**
Badger	*	*	*	*	525,000	1,500	09/01	**
Skunk	*	*	*	*	245,000	700	09/01	**
White-Tailed Deer								

* Figures for day use, FY number produced were not available
** Figures for numbers produced were not available

2.132 There is also a significant amount of habitat for upland game, small game, and furbearers along this same reach. The species present are generally similar to those on the refuges. The quality of habitat is variable as it is for the semiaquatic species. The acreage of habitat (both agricultural and non-agricultural, but excluding cultural areas such as roads and farmsteads) is 3,362 acres of private land below elevation 1620 above the Upper Souris NWR and 35,080 acres of nonagricultural and agricultural habitat within the 5,000 cfs outline between the two NWR's. These 38,442 acres lie within the primary area of impact of Burlington Dam, and there would be an additional area subject to any induced development, land-use change, or more intensive land use due to real or perceived benefits of the project. Using these acreages and data on the densities of indicator wildlife species ½ mile on either side of the Souris River in Manitoba (IGDSB, 1976:12), population estimates for the major upland wildlife species could have been calculated. However, this was not done because the estimates would be unreliable due to reasons which include:

1. Dissimilarities in the habitat type breakdown between the U.S. and Canadian studies.

2. Lack of field evaluations to determine the comparability in habitat quality in the United States and Canada along the Souris.

3. Changes in wildlife populations with time due to weather, cyclic phenomena, disease, land use trends, etc.

4. Difficulty in obtaining accurate and/or repeatable population estimates and/or indices; and

5. The difference in population estimate area between a mile-wide corridor (IGDSB, 1976) and a 5,000 cfs outline.

Suffice to say there would be very substantial terrestrial wildlife populations on private lands within the area of impact of Burlington Dam. Probably the most significant populations are of whitetail deer (which must depend upon the valley for food and shelter during critical periods) and waterfowl.

<u>Other Areas</u>

2.133 The rest of the Souris basin also produces large amounts of wildlife. Much of the more productive area is adjacent to tributaries of the Souris River. Wildlife production data (e.g., from the Des Lacs NWR) are not presented here, and the reader is referred to that part of section 4 dealing with wildlife impacts for some pertinent information.

FISH

2.134 Fish species found in Lake Darling and the Souris and Des Lacs Rivers are generally characteristic of warm waters in the Midwest, with one notable exception. Twenty-four fish species are known to inhabit the area, with northern pike, fathead minnow, white sucker, black and brown bullhead, yellow perch, and walleye being considered very common. Carp, however, are not present in the Souris River in the United States, making it a unique river. Carp are found in the Assiniboine River, and occasionally in the Souris River as far upstream as Melita, Manitoba (River Mile 124), at which point they have surmounted five of six lowhead dams. The absence of carp in J. Clark Salyer NWR is speculated to be due to low flow and low D.O. It has also been speculated that the increased flows accruing to the Souris from Garrison Diversion Unit return flows would provide conditions suitable for migration and survival of carp in the Souris River in the United States.

2.135 Lake Darling currently maintains an excellent walleye and northern pike fishery (standing crops estimated at 35 and 20 pounds/acre, respectively) as well as yellow perch and black bullhead. Northern pike in the 15- to 20-pound range, walleyes from 5-9 pounds, and yellow perch in excess of one pound are not uncommon in the angler's catch. In 1971, creel census data indicated a total annual catch from Lake Darling of almost 100,000 fish with a total weight of about 60,000 pounds. Game fish accounted for 19 percent of the angler catch by number and 71 percent by weight. Average catch rate for the year was estimated to be 0.5 fish/hr with an average weight of 0.3 pounds.

2.136 Natural reproduction, downstream movement of fish from Canadian impoundments, and stocking efforts have contributed to the successful sport fishery in Lake Darling. Stocking programs are most important for walleye and to rebuild standing crops of game fish following winterkill years (such as 1966-1967) During the period from 1967-1970 following the severe winterkill in the winter of 1966-1967 (which is discussed in more detail in paragraph 2.73), 38 percent of Lake Darling's game fish population was attributed to natural recruitment and the remainder was attributed to stocking efforts. During 1975, however, it has been estimated that natural recruitment accounted for over 90 percent of the game fish population.

2.137 Excellent spawning habitat for northern pike exists in the upper end of Lake Darling and in the marsh impoundment (Dam No. 41) upstream from Lake Darling. Spawning of northern pike generally takes place following ice-out and has been successful in recent years which have required minor flood storage of appropriate duration behind Lake Darling Dam. Walleye spawning, which usually follows completion of northern pike spawning, is generally restricted to areas in the lake along the wave-washed shores and below impoundments in the river where clean gravel and rock can be found.

2.138 Rooted aquatic plants (mostly Sago pondweed) cover much of the littoral zone of Lake Darling (on silt and organic mud substrata) while protected bay areas support emergent aquatic plants.

2.139 Major limiting factors to the Lake Darling sport fishery have been identified as eutrophication and related algal blooms, siltation, and reservoir drawdown for flood control.

2.140 Fish species inhabiting the downstream reaches are similar to those in Lake Darling, with minnows comprising 78 percent of the total sample catch, and walleyes and northern pike contributing 9 and 5 percent of the sample catch, respectively. Spawning habitat for game fish in the downstream area is limited for walleyes to areas below lowhead dams and isolated gravel-rubble-riprap deposits while northern pike spawning is available in Upper Souris NWR marsh units and in J. Clark Salyer NWR. Salyer has extremely good northern pike spawning conditions, but winterkill conditions in these shallow impoundments have limited any fishery management efforts in these areas. For the most part, the downstream fishery (between Minot and J. Clark Salyer NWR) is poor, depending on Lake Darling for its stock, and varies considerably, depending on existing flow conditions. The North Dakota Game and Fish Department reportedly has not studied the area because of poor water quality and because more productive areas exist.

SOCIAL CONTEXT

2.141 The early settlers built their homes and businesses in the Souris River valley in order to take advantage of the natural shelter from severe winter cold and summer heat, and to be near accessible water. This pattern of development has persisted to the present despite a series of very damaging floods since 1969 (unlike the period just before 1969 which was flood-free in comparison in having only infrequent large floods) and new requirements for floodplain management. Today the floodplain of the Souris River is still regarded as a prime homesite area. Some 3,538 permanent residences and 296 businesses, as well as local utilities, 15 churches, and seven schools, are now situated on the 100-year floodplain at Minot. Approximately another 579 permanent residences are located on the 100-year floodplain in nine growing subdivisions in 7 communities protected by emergency levees between Minot and Burlington, between Minot and Logan, and at Sawyer, Velva, and rural areas below Minot. Floodplain areas in Minot, Ward County and Velva are covered by floodplain regulations; the other floodplain areas are not yet.

2.142 There are 30 residences in the Souris River valley below elevation 1620 and north of the selected dam site, between Burlington and the Canadian border. As discussed in the paragraph on land use, most of the valley above Burlington is occupied by relatively large farms or ranches and the Upper Souris National Wildlife Refuge. Some of the rural residents of these farms and ranches are descendants of early settlers of the Souris River valley. The farms and ranches have, in many cases, been occupied and worked by several generations of families. The ties to homes and lands in this area are therefore quite strong in many cases. Relative to the urban floodplain at Minot,

floods in the rural area do not affect a great number of people. Many of the flood problems of rual residents are similar, although some of the rural residents also gain advantages in compatible activities such as flood irrigation of hay lands. Also the proportion of floodplain residents is much lower for the upstream rural area than for Minot. All but a few of the rural residents are not in floodplain locations except when large reservoirs, such as Burlington Dam, are constructed.

Population

2.143 The United States portion of the Souris River basin, an area of 9,320 square miles, lies in northwestern North Dakota and the northeastern tip of Montana. The stretch of the Souris River lying within North Dakota is 358 miles long; the basin includes essentially all of Renville, Ward, McHenry, Bottineau, and Rolette Counties, and parts of several others. In 1970 the basin's population was approximately 94,600, sixty-two percent of which was in Ward County, including Minot and the U.S. Air Force Base.[1]

2.144 Population in the Souris River basin is expected to increase about 30 percent during the period 1970-2020.[2] In general, rural farm population is expected to decline while urban and rural nonfarm populations are expected to increase.

2.145 Minot, the largest city, is expected to experience the highest growth rate in the basin--its 1970 population of 32,290 is expected to reach 65,000 by the year 2030, an increase of about 100 percent (table 11). During the same period, Ward County, which includes Minot, is expected to increase its 1970 population of 58,560 (which includes military personnel) by 88 percent.

2.146 In 1970, 20,000 persons resided in the immediate vicinity of Minot, but outside the present municipal limits. Thus, the 1970 population of the total Minot urbanized area was more than 52,000. A special census conducted by the city of Minot indicated a 1975 population of 32,823, an increase of 533 persons, or 1.7 percent, over the 1970 population.

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[1] Historical population data were obtained from the U.S. Bureau of the Census. Population projections were derived from projections by the U.S. Department of Commerce.

[2] Although the general guidance of Engineering Regulation 1105-2-105 stipulates that futures projections will span the project life, it is unsound and misleading to present population projections beyond 50 years for an area of the present size. There are no correction or adjustment formulas which will provide defined stability within known ranger limits for population figures projected beyond 50 years. In the interest of the credibility of the agency, the full intent of cited regulatory guidance is upheld by the OBERS data alone, as shown in table 11.

Table 11: Population Projections, Selected North Dakota Communities, Counties, and the Souris River Basin[1]

Community	1960	1970	1973	1980	1990	2000	2010	2020	2030
Minot[2]	30,290	32,290	33,523	34,500	36,000	41,000	48,000	56,000	65,000
Sawyer	390	373	387	420	450	480	550	620	700
Velva	1,330	1,241	1,243	1,250	1,260	1,270	1,340	1,420	1,520
Ward County[3]	47,072	58,560	60,473	62,000	67,000	75,000	85,000	96,000	110,000
Renville County	4,698	3,828	3,699	4,000	4,300	4,400	4,500	4,700	4,900
Souris River basin	90,213	94,603	-	95,000	98,000	103,000	112,000	122,000	133,000

(1) Based on the OBERS projections of 1972, Series "C".

(2) A 1975 special census showed a Minot population of 32,823.

(3) Includes constant military population of 12,077 from 1970 to 2020.

Land Use

2.147 Minot is the only urban center in a predominantly agricultural region. The American portion of the Souris River basin is the core of this agricultural region, but it extends considerably beyond the basin. The region's wholesale and retail trade, business and agricultural services, and medical and other professional services are highly concentrated in Minot.

2.148 In the city of Minot, land-use classifications are residential, commercial, light industrial, heavy industrial, parks and recreation, public and semipublic, and streets and railroads. Developed land in the city of Minot increased from 3,520 acres in 1957 to 5,070 acres in 1966, an increase of 44 percent. Residential use accounted for the largest acreage, 31 percent of the developed area in 1966, an increase of 60 percent over 1957 acreage. The second largest use of land was for streets and railroads, which occuped 28 percent of the city's developed area in 1966, an increase of 50 percent over 1957 acreage. Acreages in both the commercial and light industrial categories are small, but each category increased 200 percent from 1957 to 1966. Acreage in parks and recreation increased 41 percent. Aside from vacant land, the only land-use category which declined during the 9-year period was heavy industrial, which declined 18 percent. No comprehensive land-use survey has been made in Minot since 1966. However, based on growth in population, it appears likely that growth in acres of land used for the various classifications has continued since then.

Comparison of land uses in Minot, 1957-1966

Urban land use	Area in acres 1957	Area in acres 1966	Percentage of total developed area 1957	Percentage of total developed area 1966	Percentage of change 1957-66
Residential	995	1,590	28.3	31.4	+59.8
Commercial	100	300	2.8	5.9	+200.0
Light industrial	80	240	2.3	4.7	+200.0
Heavy industrial	55	45	1.6	0.9	-18.2
Public and semipublic	1,115	1,155	31.7	22.8	+3.6
Parks and recreation	220	310	6.2	6.1	+40.9
Streets and railroads	955	1,430	27.1	28.2	+49.7
Total developed land	3,520	5,070	100.0	100.0	+44.0

Source: "Comprehensive Plan, Minot, North Dakota," Harland Bartholomew and Associates, St. Louis, Missouri, 1969.

2.149 Currently, the major land use in Minot is residential, mainly single family, occupying 27 percent of the land. (This percentage is deceptively small, due to the increase in Minot's total area.) In recent years, residential land has been developed both inside and outside the city limits. Commercial land uses 4 percent of the city's area. Most industries within Minot have been developed along rail lines, near the center of the community. Commercial land use has developed in the central business district and along main traffic arteries. Public and semipublic uses, including parks, occupy 25 percent of the area. Streets and railroads occupy 21 percent of the total area while open space represents 19 percent. The total land area of the city of Minot is about 8 square miles or 5,187 acres.

2.150 The 100-year Minot floodplain occupies about 37 percent of the total area of Minot. About 50 percent of the floodplain is in residential use. The next largest land use category in the floodplain is streets and roads, about 13 percent of the area. The balance of the area is distributed among commercial, industrial, public, and park uses, and railroads and vacant lots. Less than 2 percent of the Minot floodplain is vacant.

Comparison of land use on the 100-year floodplain, Minot, 1957-1966

Urban land use	Area in acres 1957	Area in acres 1966	Change (1957-66) Percent	Change (1957-66) Acres
Commercial	44	101	130	+57
Industrial	31	78	152	+47
Railroads	112	114	2	+2
Streets and roads	198	243	23	+45
Residential (developed)	673	959	42	+286
Residential (vacant lots)	-	42	-	-
Public and semipublic	139	186	34	+47
Parks	104	161	55	+57
Total developed area	1,301	1,884	45	+583

2.151 Upstream from Minot in Ward County and in the floodplain are seven communities with a total of about 200 single-family residences on one-half acre lots. Most of the residences were constructed in the 1960's but some have been constructed since the 1969 flood. Additional lots in these areas have been platted but remain vacant due to local zoning ordinances. One small community was constructed in Ward County in the floodplain downstream between Minot and Logan prior to 1969.

2.152 Non-urban land use distributions in the study area between the proposed Burlington Dam and the Saskatchewan border are shown in table 5 on page 49 of this document. Development at Minot, the major point of project flood protection, is given further perspective in the context of the total study area 100-year floodplain by the data in table 12. The areas shown comprise the uses and acreages below the proposed Burlington Dam.

Public Health and Safety

2.153 The project area has not suffered significantly from public health problems associated with flooding, because local health authorities have taken several precautions. Disposal of debris and garbage is well planned, and consequently there are few bank-dwelling rats to be forced to higher ground during flood conditions. Usually Minot does not have a mosquito problem in normal water level years. Following the 1969 and 1975 floods, due to pooled waters, mosquitos bred in large numbers and did cause nuisance problems. There had been reports of equine encephalitis in the State prior to the 1969 flood, thus the Minot area was tested for the vector (the mosquito *Culex tarsalis*). The vector was found in limited numbers and showed negative for encephalitis.[1] After the 1975 flood *Culex tarsalis* was implicated generally in the western encephalitis epidemic in North Dakota. Private wells with faulty casings have been found to be contaminated with coliform bacteria; however, very few problems concerning sewage or municipal water supply have occurred. Two houses in Minot exploded and burned during the 1969 flood, and a death from drowning was reported in connection with high Des Lacs River flows in 1970.

Government

2.154 The form of municipal government in Minot is Council-Manager, with a fourteen-member council. Elections are by ward on a non-partisan ballot. The mayor is directly elected by popular vote. For fiscal year 1976-77, the municipal budget was $19,628,094 derived primarily from sources shown in table 13. The same year there were 265 full-time municipal employees.

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[1] Cilke, Roger C., 1974. Personal Communication. First District Health Unit, Minot, North Dakota.

TABLE 12

Summary of approximate acreage, population, and developments in 100-year Souris River floodplain

River reach	Acres	Population	Developments				
			Permanent residences	Commercial	Schools	Tax exempt	
						Churches	Other
Burlington to Minot	1,760	550	166	-	-	-	-
Minot	2,775	12,000	3,538 (1)	296	7	15	18
Minot to Logan	2,615	120	46	-	-	-	-
Sawyer	120	60	21	2	-	-	-
Velva	350	930	330	45	1	3	-
Rural area (Logan to J. Clark Salyer Refuge)	48,000	190	61	-	-	-	-
Total	55,620	13,850	4,162	343	8	18	18

(1) Does not include mobile homes.

Table 13: Anticipated Sources of Revenue, Minot F.Y. 1976-77

Sources	F.Y. 1976-77
Tax Budget	$2,254,328
Sewer, Water	2,570,000
Airport	1,876,000
Community Development	1,128,000
Special Assessments	4,750,000
*Debt Fund	1,335,000
Additional Tax Revenues (from various sources)	1,000,000

* Derived primarily from bonds for construction

Economy

2.155 The Minot Retail Trade Area consists of nine counties comprising 13,500 square miles. The population in 1970 was 114,000. At the core of the retail trade area is the United States portion of the Souris River basin.

2.156 Minot maintains a strong position as a trade and transportation center and its future in this respect seems assured by the size and resources of its trade area. Included in the trade area are considerable mineral resources, an Air Force base, and vast agricultural resources.

2.157 Agriculture is the Minot region's basic export industry and the foundation of the regional economy. Earnings from sales of farm products make possible most of the region's purchases of goods and services from other regions. Data pertaining to agriculture in the Souris River basin are presented in table 14. Money also comes into the region from production and sale of petroleum and from Federal expenditures for national defense. However, petroleum and defense are of secondary importance to the regional economy in comparison with agriculture. Output of petroleum is declining and known reserves are limited, in contrast with the large and expanding agricultural output. Further, the magnitude in future years of expenditures for the Minot air base cannot be foreseen.

2.158 Agriculture is of primary importance in the Minot retail trade area and in the Souris River basin. In the five counties which closely correspond to the basin, there were 5,265 farms in 1969 with an average size of 854 acres. The gross income in 1969 of the basin's farmers and ranchers was $87 million, as measured by the market value in 1973 prices of all farm products. The value of farm products' net of production costs amounted to approximately $29 million. About 27 percent of farm income in the basin was derived from sales of livestock, mainly beef cattle. In accordance with agricultural practices suitable for northern North Dakota, 40 percent of all cropland is left fallow each year. Between 1969 and 1974, the relative value of crops to total agricultural value increased from 73 percent to 84 percent. There was a corresponding decline in the relative value of livestock production. Wheat, hay, oats, flaxseed, barley and rye are the principal crops; some corn and potatoes are also grown.

Table 14: Agricultural Characteristics, Souris River Basin, 1974

Characteristics	COUNTY Ward	McHenry	Bottineau	Renville	Rolette	Total Souris River basin
Number of farms	1,468	1,168	1,217	558	623	5,034
Average size of farms (acres)	841	994	891	928	821	895
Market values of all farm products sold ($1,000)	53,493	33,713	49,437	22,898	19,970	179,511
Market value of all farm products sold	36,440	28,964	40,622	41,036	32,055	179,017
Value of farmlands and buildings ($1,000)	235,343	173,546	264,167	98,421	92,756	864,233
Value of farmlands and buildings per acre	191	150	244	190	181	191
Value of machinery and equipment ($1,000)	51,302	35,314	45,828	21,658	20,798	174,900
Total value, farmland, buildings, machinery, equipment ($1,000)	286,645	208,860	309,995	120,079	113,554	1,039,133
Farm production costs ($1,000)	26,703	10,391	23,017	10,771	10,505	81,387
Value crops sold ($1,000)	44,461	23,573	45,522	21,138	17,053	151,747
Percent crops sold	83	70	92	92	85	84
Value livestock and poultry sold ($1,000)	9,032	10,139	3,914	1,760	2,916	27,761
Percent livestock and poultry sold	17	30	8	8	15	16
Value forest products ($1,000)	0	0	0	0	0	0
Percent forest products sold	0	0	0	0	0	0

2.159 According to the U.S. Soil Conservation Service, there are no unique farmlands in the project area, i.e., those which derive their special advantage from growing specialty crops. There are prime farmlands, however, in Ward and Renville Counties, mostly adjacent to the Souris River and within the Upper Souris National Wildlife Refuge. There are also several acres of prime farmlands within the Burlington pool area above the 0.5-percent chance storage elevation. Detailed soil surveys have not been completed for McHenry and Bottineau Counties, but general survey maps indicate the soils are either too sandy or wet to be in the unique or prime categories.

Employment

2.160 Employment in Ward County, excluding government, increased from 16,443 in 1970 to 24,288 in 1974, a gain of 48 percent (tables 15 and 16). Much of this gain was due to an increase in military personnel. Military employment increased from 1,744 to 6,228 over this period, a gain of 257 percent. This change reflects the completion of construction at Minot Air Force Base. During the 1970-74 period, employment increased significantly in manufacturing, wholesale and retail trade, finance, insurance, real estate, and services.

2.161 As of April 1977, 6.0 percent of the civilian labor force of Ward County was unemployed. The labor force consists of persons who are working or actively seeking work. Potential workers, such as married women and students who would seek work if jobs were more abundant, but who are not actively seeking employment, are not classified as part of the labor force.

Table 15: Employment by Industry, Ward County, 1970, 1974*

Industry	1970[1] Number	%	1974[2] Number	%
Mining	61	0.4	41	0.2
Construction	1040	6.3	1033	4.3
Manufacturing	847	5.2	1034	4.3
Transportation, Communication, and Utilities	1649	10.0	1477	6.1
Wholesale and Retail Trade	4787	29.1	5560	22.9
Finance, Insurance, and Real Estate	667	4.1	761	3.1
Services	3867	23.5	4351	17.9
Armed Forces	1744	10.6	6228	25.6
Other	1781	10.8	3803	15.7
TOTAL	16,443		24,288	

* government employees are not included

1 U.S. Bureau of the Census

2 U.S. Department of Commerce, Bureau of Economic Analysis

2.162 Total employment in Minot, excluding the remainder of Ward County, increased from 11,420 in 1970 to 12,272 in May 1977, a gain of 7.5 percent. (This is a conservative estimate, as 1977 figures included only "covered" workers. See table 15.) Significant increases occurred in the following categories: transportation, communications, and utilities; wholesale and retail trade; finance, insurance, and real estate. The strongest gain was in the wholesale and retail trade category, increasing from 3,548 to 4,903, or 38.2 percent, over this period (table 16). A reduction in employment occurred in the following categories: mining, construction, and services.

2.163 The most significant reduction was in the services category, showing a decline from 4,485 in 1970 to 3,606 in 1977, a decrease of 19.6 percent (table 16). Much of this appearent decrease, however, might result from the exclusion of "non-covered" workers from the 1977 data.

Table 16: Employment by Industry, Minot, N.D.*

Industry	1970[1] Number	%	**1977[2] Number	%
Mining	34	0.3	26	0.2
Construction	681	5.9	674	5.5
Manufacturing	693	6.1	744	6.1
Transportation, Communication and Utilities	1,314	11.5	1,515	12.3
Wholesale and Retail Trade	3,548	31.1	4,903	39.9
Finance, Insurance, and Real Estate	533	4.7	804	6.6
Services	4,485	39.3	3,606	29.4
Other	132	1.2	-	-
TOTAL	11,420	-	12,272	-

* Government employees are excluded from this table.
** Current figures for May 1977 reflect only those workers covered by unemployment insurance.

1 U.S. Bureau of the Census

2 State of N.D., Department of Employment Services

Income

2.164 Actual per capita income for Ward County in 1975 was $5,546, compared with an average of $5,781 for the State of North Dakota. Although actual per capita income figures for the city of Minot in 1975 are not available, it can be expected that income in Minot will be higher than that of Ward County because Minot is the center of the regional economic area. Data on per capita income in 1967 dollars for the 16-county Minot Economic Area (BEA area 093) and for the State of North Dakota were furnished by the U.S. Department of Commerce, Bureau of Economic Analysis, as shown in table 17.

Table 17: Per Capita Income for Minot Economic Area and State of North Dakota.[1]

Year	Minot Area	North Dakota
1971[2]	$2,931	$3,019
1980[3]	3,751	3,941
	(27.9 % change)	(30.5 % change)

[1] In 1967 dollars

[2] Revised Estimate

[3] Adjusted Projection

Education

2.165 According to the 1970 Census, the educational levels of persons 25 years of age and over in Minot, Ward County, and the State of North Dakota were as shown in table 18.

Table 18: Educational Attainment Levels*

	Minot		Ward County		N.D.	
Educ. Level	Number	%	Number	%	Number	%
8th grade or under	3,939	25.5	6,999	25.9	122,998	38.6
1-3 years high school	1,788	11.6	3,204	11.9	35,153	11.0
High school degree	4,737	30.7	9,122	33.8	87,806	27.6
1-3 years college	3,062	19.8	4,552	16.9	45,680	14.3
4 or more years college	1,902	12.3	3,083	11.4	26,702	8.4
Median Years Completed	12.4		12.4		12.0	

* U.S. Bureau of the Census, 1970

2.166 The median number of years of formal education attained does not differ greatly among city, county, and State. However, there is a marked progressive decline in the percentage of college graduates between Minot and the State at large. This pattern is consistent with the predominance of agriculture in the economy of the State and few significant urban concentrations of population (other than Minot) which would present occupational structures requiring higher educational attainments. Residents of Minot and the surrounding area are served by three post-secondary educational institutions located within the city: Minot State College, Minot Business College, and Northwest Bible College.

Transportation

2.167 Rail service was instrumental in Minot's development as a major trade and transportation center in North Dakota. Ward County is presently served by two major railroads, Burlington Northern and Soo Line. Burlington Northern maintains its division headquarters at Minot, while the Soo Line parallels the project area. Passenger service is provided by Amtrak. This pattern is slowly changing as airlines and trucking companies become increasingly competitive in the freight industry. Also, most forms of shipping are becoming increasingly automated, reducing some types of jobs in the field. Despite this moderate decrease in numbers of jobs, continued income growth is expected.

2.168 The highway network throughout Ward County consists of three Federal highways, U.S. 2, 52 and 83; and two State highways, 23 and 53. U.S. 2 runs east and west, U.S. 52 crosses the county diagonally from northwest to southeast, and U.S. 83 runs north and south. These highways intersect at Minot and are supplemented by numerous local roads to provide adequate circulation through and within the county. Daily bus service is available to Minot from Grand Forks, Jamestown, and Bismarck. Minot International Airport is served by two major airlines, North Central and Frontier, which offer a total of five flights daily. In the Renville County portion of the project area (north of Lake Darling Dam) there are three principal transportation routes linking local communities with major arterial routes. These include the Soo Line Railroad and State Highway 28 (FAS 752) crossing Lake Darling and State Highway 5 crossing the Upper Souris River valley north of Lake Darling.

RECREATION

2.169 Recreation Needs: The 1975 North Dakota State Comprehensive Outdoor Recreation Plan identifies the major recreation needs within the region as access to lakes and reservoirs, and camping, tennis, and golf facilities.

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2.170 Existing Conditions: Lake Darling and the area downstream are regarded as one of the most important fishing resources in North Dakota. Approximately 10 percent of the annual fishing in North Dakota occurs at Lake Darling. In 1971, 94 percent of the fishing pressure came from the Minot Air Force Base or the city proper. The highest fishing pressure occurs during the spring and early summer. Further information on use of the fish stock, as well as more basic information on the fishery, is found in paragraphs 2.134-2.140.

2.171 The most important aspect of the Souris River between Lake Darling and Burlington has been its function as waterfowl habitat. During the fall, hunting outside of wildlife refuge boundaries is a major activity. Fishing and picnicking at two sites on the river, Baker Bridge and St. Mary's Bridge, are also important recreation activities. St. Mary's Bridge receives approximately 10 percent of the total annual refuge recreation activity and Baker Bridge receives approximately 30 percent.

2.172 Formal recreation areas within the city of Minot adjacent to the river are limited to Oak Park and Roosevelt Park. Activities at both parks are similar, consisting of open space activities such as picnicking and field games. River-oriented activities consist of fishing and boating. Swimming is not encouraged, however, due to poor water quality. With channelization, potential to create a larger park and open space system along the river is created. Plans for the system have been developed.

CULTURAL RESOURCES

2.173 In compliance with Section 106 of the National Historic Preservation Act of 1966 and Executive Order 11593, the National Register of Historic Places has been consulted and as of 3 January 1978 there are no properties that have been included on or determined eligible for inclusion on the Register that are located within the project impact areas. The Nationally Registered Eastwood Park Bridge and the Soo Line Passenger Depot in Minot will not be affected by the project. The National Register will continue to be consulted and the St. Paul District will be requesting determination of eligibility during later design stages. Coordination will be initiated with the State Historic Preservation Officer and the Advisory Council on Historic Preservation regarding any Registered properties that are to be affected by the project. It has also been determined that no properties listed on the National Registry of Natural Landmarks are in the project area. Copies of the draft environmental impact statement were provided to the National Park Service, the North Dakota State Archaeologist, and the State Historic Preservation Officer for their review and comment (see comment/response section).

2.174 In order to identify the cultural resources located within the various project areas, several studies were conducted under contract with the St. Paul District, Corps of Engineers. A reconnaissance survey was completed in 1975 by the State Historical Society of North Dakota.

This reconnaissance included surface examinations of the proposed Burlington dam site and portions of the pool area, the Des Lacs Tunnel area, and the channel modifications in the vicinity of Minot. Ten prehistoric sites were located by the survey, including three rock cairns, one burial mound, four stone alignments, and two isolated artifact finds. These sites are all located in the Burlington pool area; however, four are located outside of the impact area.

2.175 A record and literature search to complement this reconnaissance was conducted in 1977 by the University of North Dakota. This study included a review of the known prehistoric, historic, architectural and paleontological resources of the Upper Souris River basin. Information obtained from local informants and from historical accounts identified 786 possible prehistoric, historic, and architectural sites for Bottineau, McHenry, Renville and Ward Counties. Many of the site leads were recorded a number of years ago, so the location and description are often faulty. In addition, many of these reported sites have probably been disturbed or destroyed in the intervening years. Subsequent field surveys will determine how many of these site leads are located within project impact areas.

2.176 The University of North Dakota is presently under contract with the St. Paul District, Corps of Engineers to conduct an archaeological and historical field survey of the various project areas. The final results of this investigation will not be complete until the end of 1978. Preliminary information from the archaeological survey has located 40 prehistoric sites in the areas covered. The historical/architectural research and field work has not been conducted. The potential significance of the cultural remains will be evaluated according to the National Register criteria. This contract was designed to include the proposed areas of construction (Des Lacs diversion tunnel, levee improvements, road relocations, and designated borrow areas), the Lake Darling pool raise, the Burlington Dam dry reservoir area, and portions of the area north of the head of Lake Darling to the Canadian border.

2.177 Future cultural resources investigations will be conducted during later design stages. These investigations will involve subsurface testing for buried sites where there is a high potential for such sites. Other project areas not previously surveyed will be included as the project designs and impact areas are finalized. Intensive testing of all cultural resources located within the project impact areas will be completed. The St. Paul District will be requesting determinations of eligibility from the Secretary of the Interior following completion of cultural resources identification and evaluation investigations. All properties determined eligible for inclusion on the National Register of Historic Places will be avoided, if possible, or any adverse impacts will be mitigated, following consultation with the State Historic Preservation Officer, the National Park Service, and the Advisory Council on Historic Preservation. Mitigation will not proceed until initial receipt of construction funds.

2.178 A number of comments (see comment/response section) were received regarding the lack of sufficient data concerning cultural resources, preventing adequate assessment of the impacts by the public. The cultural resources regulations (published in the Federal Register of 8 September 1975) developed by the Corps of Engineers for its civil works projects provide for the collection of these data in several stages, as the planning and design advances, and as funding is appropriated for construction. During the current stage of planning, the cultural resources investigations are primarily reconnaissance level, consisting of record and literature research and field examinations of selected protions of the areas to be affected. We are currently proceeding with an investigation which is partially reconnaissance level and partially intensive survey, because of the large areas involved and varying degrees of potential impact. Actual construction areas and areas with most frequent inundation will have a higher priority at this time. During later design stages, all other project lands will be surveyed and all determinations of eligibility and Memoranda of Agreement regarding mitigation measures will be completed. Upon initial receipt of construction funds, agreed-upon mitigation measures will be accomplished.

2.179 The results of future cultural resources investigations, correspondence, and executed Memoranda of Agreement will be incorporated in later documents (General and Feature Design Memoranda). Although these documents are not distributed as widely as the environmental impact statements, they will be provided to the cultural resource review agencies, which include the Council on Environmental Quality, the Advisory Council on Historic Preservation, the State Historic Preservation Officer, and the National Park Service. In addition, the State Historic Preservation Officer and the National Park Service will be provided copies of our ongoing and future cultural recource investigation reports for their review and comment.

2.180 The review of paleontological resources identified several areas in the upper Souris River basin where there are outcroppings of the Paleocene Tongue River and Cannonball Formations of the Fort Union Group. Areas that may require further investigation and/or monitoring during construction include the Burlington Dam site, the Des Lacs diversion tunnel, the areas where emergency levees would be upgraded, and the borrow pits and access roads in these areas.

Prehistoric

2.181 The prehistory of the Souris River Valley in North Dakota is largely unknown because the area has never been systematically surveyed by professional archaeologists, nor have any sites ever been excavated. Much of the information that is available comes from research done in other parts of North Dakota, and southern Manitoba and Saskatchewan.

2.182 With the retreat of the glaciers and the gradual revegetation of the landscape, nomadic big game hunters moved onto the northern plains. Often referred to as Paleo-Indians by archaeologists, there is not much evidence remaining to tell us about their lifestyle. Their past existence is indicated by distinctive projectile points which were used for hunting now-extinct bison and mammoth. Several of these projectile points, which may date to 9,000 BC, have been found to the west of the Souris River and in western and southwestern Manitoba.

2.183 Following a climate change to more moderate temperature, a number of new food resources became available to prehistoric people. Communities appear to have been less nomadic, and subsistence patterns were based on locally available foods. The artifacts found from this period indicate greater cultural diversity resulting from adaptations to different environments. These adaptations to local resources are considered part of a widespread cultural pattern known as the Archaic. The Plains Archaic in this area dates from about 3,000 BC to 1,000 or 500 BC. It has been conjectured that the greatest number of sites in western North Dakota will date from this period rather than from the other prehistoric periods.

2.184 The next cultural tradition, referred to as the Woodland, is characterized by the appearance of pottery and the construction of burial mounds. These innovations came from eastern and southern parts of the United States, and appear to have followed the river valleys from the woodlands into the plains. The Upper Souris basin area appears to be the northwestern extent of the mound builders. There is one recorded burial mound in the proposed Burlington pool area, and several reported campsites dating from this period are reported for the basin.

2.185 The appearance of agriculture encouraged the development of a sedentary village lifestyle. By 800 AD, the cultivation of maize, beans, and squash was established on the eastern plains, primarily along the Missouri and other rivers. The people lived in stockaded villages, farming the floodplain and hunting the game from the riverine and prairie environments. This adaptation was known as the Plains Village Complex and persisted until European contact disrupted the pattern. It seems reasonable to assume that evidence of the Plains Village adaptation will eventually be discovered in the Souris River Valley.

2.186 Pressures from the European settlement to the east resulted in a movement of numerous Indian groups westward, causing intertribal strife as the groups had to adjust to new social and environmental

conditions. European horses were acquired from the south and west, and a number of formerly agricultural groups changed their mode of life to nomadic bison hunting as they moved onto the western plains. Some of the Plains Village people continued their pattern, combining bison hunting (with guns and horses) with farming and trading.

Historic

2.187 The historic period began in 1738 with the arrival of the French explorer and trader LaVerendrye. According to historic accounts, he passed through the Souris Valley en route from Fort La Reine on the Assiniboine River in Canada to the Mandan Indian villages located on the Missouri River. Although the route he took is uncertain, he probably passed along the east side of the Souris River, stopping at an Assiniboine village, possibly near the present site of Minot. This was a major commercial route dating back to 1672 when the first fur post was established at Hudson Bay. Although the archaeological remains of the Verendrye campsites may not be distinguishable, if one were located, it would be of major significance.

2.188 According to LaVerendrye, at the time of his arrival the Souris Valley was occupied by groups of Assiniboine Indians who were living in permanent villages along the river. The location of these reported village sites is not known, but their remains may be located during the intensive field survey. The valley was also probably frequented by parties of the Hidatsa, Cree, Chippewa, Mandan, and Dakota.

2.189 With the influx of European fur traders to the area, a number of intermarriages with the Indian population produced a group known as the Metis. This combined Indian and French heritage developed into a distinctive ethnic identity and way of life, focusing on buffalo hunting and fur trapping. Their settlement patterns are of interest because they generally followed the settlement practices that were used in France, thus reflecting the continuity of certain conditions despite a radical change in economic and social organization. It is uncertain whether any of their permanent settlements will be encountered, but it is likely that some temporary sites will be present.

2.190 The fur trade remained under the control of the French until the 1780's. By the early 1790's the British Hudson Bay Company became actively involved with the fur trade in the region, with traders stationed on the Missouri River. It is possible that French and British trading posts may have been located on the Souris River. Further review of historical documents and field survey will determine this. One known trader, Charles Chaboillez, Jr., is known to have wintered on the Souris in 1803, although the exact location is unknown.

2.191 The English cartographer David Thompson traveled through the area in 1797, following the route between the Assiniboine River and the Missouri River. Later the American fur trader Alexander Henry followed this route in 1806. Presumably their campsites would have been small, with probably little remaining evidence of their stay.

2.192 In 1818, the Souris River area became part of the United States; however, the Hudson Bay Company did not abandon its fur trading operations below the 49th parallel until 1823. The American Fur Company, the Columbia Fur Company, and a number of independent traders soon established posts throughout the region. An American Fur Company post was located on the Souris River from 1843 to 1845, operated by Pierre Garrioch. The location of this post is unknown.

2.193 Two military expeditions traveling through the area were large enough and in the area long enough to establish extensive campsites. In 1865 General Alfred Sully led a military force to the Souris River looking for Indians involved in the 1862 Minnesota Uprising. In 1873 the international boundary was surveyed through the region under the command of Major W. J. Twining. A reported campsite of the Twining expedition is located on the east side of the Souris loop. A number of military artifacts have also been found in northern Renville County within the proposed project area. Historic accounts also report that large numbers of Dakota Indians were camped along the river in 1867, probably near the bottom of the Souris loop.

2.194 The permanent settlement period began in 1882-83, when several persons established stock ranches along the river in Renville County. The settlement of the area occurred in two phases. From 1882 to 1890 the river bottom lands of the area were homesteaded. Then following a period of drought, the second phase occurred from 1904 to 1910, at which time most of the upland areas were settled. Due to economic conditions, a large percentage of these upland homesteads were eventually abandoned, and some of their remnants are still standing. The architectural significance of any buildings and structures located within the project areas will be evaluated.

2.195 A number of short-lived towns sprang up in the Souris Valley during the early settlement period. In 1882 the town of Hackett Falls was laid out north of the present site of Towner. In northern McHenry County the town of Villard was established along the river in 1884. The St. Paul, Minneapolis, and Manitoba Railroad was built in 1886, crossing the Souris at the present site of Towner. A stagecoach from Devils Lake served the area from 1884 to 1905. There are seveal known townsites, stage stops and post offices in Renville County near the Souris River that may yield valuable information regarding pioneer architecture and early industrial activities. In addition, there are several early industrial sites reported for the Burlington area, including a number of coal mines and brickyards which may be located in or near the project areas.

3.00 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS

3.01 Under the guidance of the Corps of Engineers, St. Paul District, the city of Minot and Ward County adopted floodplain zoning ordinances in 1971. The Minot ordinance was one of the first in the country, was acceptable to the Federal Insurance Administration at the time, and qualified them for participation in the national flood insurance program. Both ordinances provided for restricting development within the boundaries of the Souris River 100-year (1-percent chance flood) floodplain. The Minot floodplain ordinance applies to the Souris River floodplain within the city limits, and the Ward County ordinance applies to those unincorporated portions of the county where the townships have ceded their zoning and subdivision powers. Three townships have ceded their zoning and subdivision powers in writing and eight have relinquished them verbally to Ward County.[1]

3.02 The Minot ordinance includes a retroactive development clause ("grandfathering") which allows for continued development within the floodplain provided that lots were annexed, platted, and utilities installed prior to the date the floodplain ordinance was adopted in 1971. Almost the entire floodplain falls under the "grandfather" clause with only about 100 lots still available for development. Development in the floodplain, even with a floodplain ordinance, is allowed to continue, provided certain construction requirements designed to reduce flood damages are met.

3.03 The Ward County ordinance provides for redefinement of intermediate regional floodplain boundaries "at intervals of not more than 5 years from the date of its original adoption and specifically within 1 year following completion of any phase of flood control work [i.e., Minot channel and Burlington Dam] which may remove the necessity for any or all of the restrictions imposed by this resolution." However, under present procedures the Federal Insurance Administration would require a restudy to determine the new limits of the floodplain for insurance purposes.

3.04 Floodplain regulations are designed to modify land use and development in order to lessen the future effects of floods. "Grandfather" clauses, however, reduce the effectiveness of such regulations. In addition, the Minot ordinance currently defines the floodway as the 1500-cfs or normal river channel which existed in 1971. This is not consistent with FIA regulations and encourages fill in the floodplain which is widespread and in some cases extends to the channel (Keifer & Assoc., Flood Hazard Mitigation Report). This can have significant effects on flood conditions.

3.05 In 1971, the city of Minot and Ward County made flood insurance available to floodplain occupants in accordance with provisions contained in the National Flood Insurance Act of 1968, Public Law 90-448. The flood insurance program is based on studies made by the Corps of Engineers, St. Paul District. Flood insurance assists in reimbursing

[1]Keifer & Associates, Inc. 1976. Flood Hazard Mitigation Report, prepared for the U.S. Department of Housing and Urban Development.

affected property owners of existing developments for losses sustained from flooding and prevents or reduces flood damages. Prior to January 1975, flood insurance was uniformly issued under federally subsidized rates. After that date, however, actuarial (risk premium) rates are effective in communities which have adopted an acceptable final floodplain ordinance after a flood insurance rate study. The only communities currently having subsidized coverage available (under the "emergency" program) are those which have indicated a willingness to participate and have adopted a preliminary floodplain ordinance.

3.06 In the decade from 1966 to 1975, two types of land use changes occurred within the Minot floodplain - residential development of undeveloped areas, and removal of residences, primarily for flood control purposes, by the city. During this period, 309 construction starts (new structures and reconstructions over $5,000) occurred within the floodplain. Of these, 243 were new structures of which 214 were residential, 22 commercial, and 7 public. The enactment of the national flood insurance program therefore had little effect on the amount of construction. There was a rash of new construction starts prior to January 1975 as developers probably attempted to qualify for subsidized insurance rates. However, following the removal of federally subsidized insurance rates, there was a drastic reduction in construction activities (Keifer & Assoc., 1976, Flood Hazard Mitigation Report).

3.07 Since 1970, 82 properties have been acquired by the city. Sixty-four of these were connected with either the Minot channel project or the city's diking program. In addition, 67 more properties are labeled for acquisition as a result of the 1976 flood (Keifer & Assoc., 1976, Flood Hazard Mitigation Report).

3.08 Other cities in the area have varying floodplain management policies. Velva has adopted a floodplain ordinance similar to that of Minot's, but is presently contesting the extensive floodway designation. Burlington was participating in the "emergency" flood insurance program as of 12 September 1977.

3.09 Between 1970 and 1975, the population of the Minot floodplain decreased by about 1,000 (600 gain in the floodplain fringe and 1,600 decline in central area). Without greater protection, this trend would probably continue. However, survey data indicated that in 1171, 34 percent of floodplain houses were substandard or deficient, while in 1974 only 29 percent in the same area were deficient (Keifer & Assoc., 1976, Flood Hazard Mitigation Report). This reflects considerable investment in the floodplain and probably indicates the anticipated construction of upstream protection and/or lack of effective floodplain regulations.

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EXISTING LAND USE PLANS

3.10 The Souris Basin Planning Council, which assists Bottineau, Burke, McHenry, Mountrail, Pierce, Renville, and Ward Counties with their planning and development activities, was contacted in regard to the proposed project's consistency or conflict with existing land use plans. They indicated that publicly adopted land use plans have not been developed to date; however, they are in the process of developing a land use program. The Basin Planning Council and the Corps both recognize the need to continue their coordinated land use planning effort.

3.11 The proposed project is consistent with the land use plans of the city of Minot.

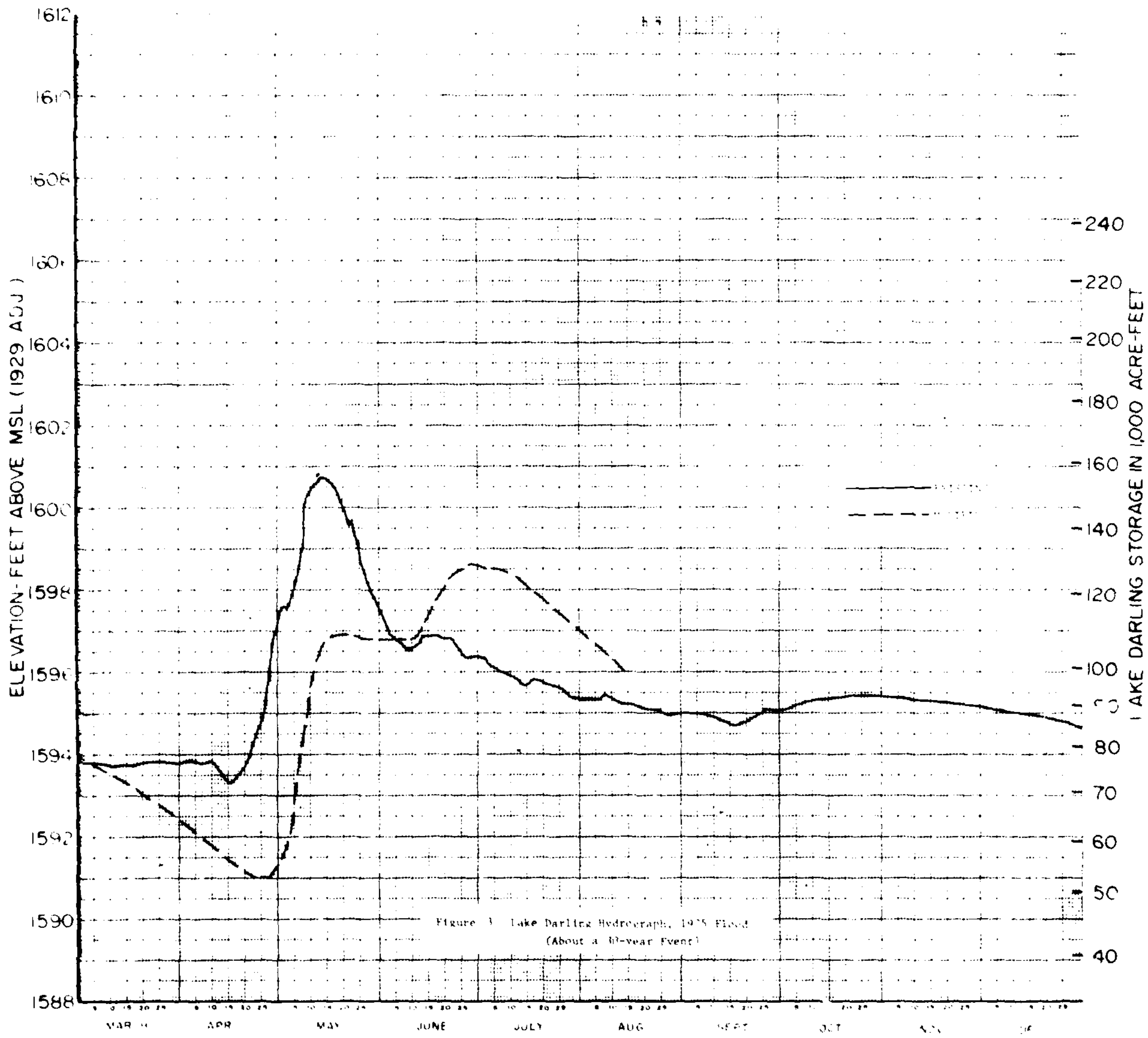
4.00 IMPACTS OF THE PROPOSED ACTION

4.01 Statistical analysis of hydrologic data indicates that floodwater storage behind Burlington Dam itself would only be required for the 2 percent and less frequent floods. The raised Lake Darling Dam would be used to regulate the more frequent flood events.

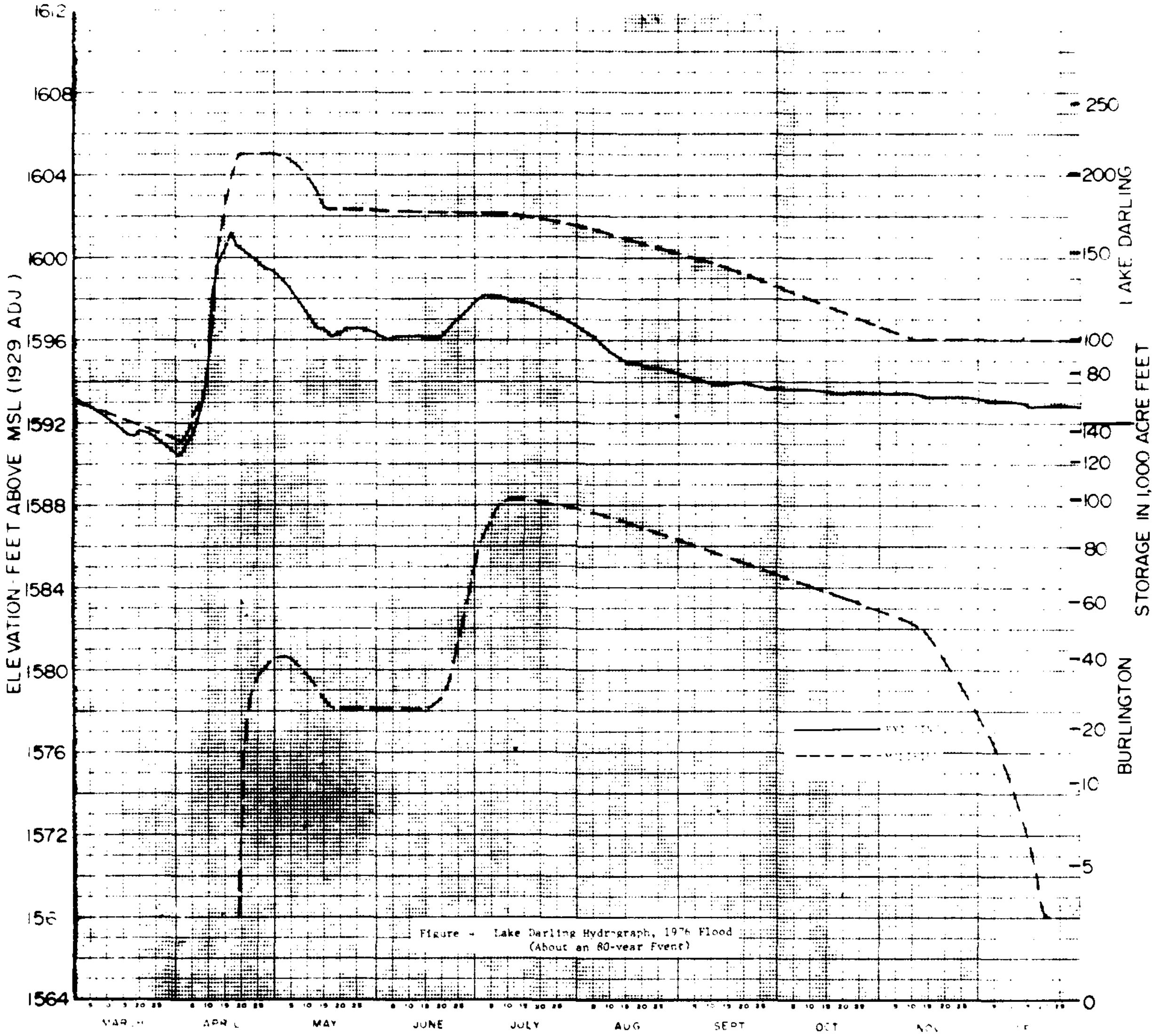
4.02 Figures 3-5 are presented so that the reader can evaluate the impacts of floodwater storage and compare the with- and without-recommended-project conditions. Figure 3 presents the actual ("existing") Lake Darling hydrograph for the 1975 flood (about a 30-year flood event), as well as the hydrograph showing Lake Darling operation as it would have been with the recommended project in place ("modified"). The "modified" hydrograph assumes drawdown to elevation 1591 (reference paragraph 1.13 d earlier). Subjective evaluation of impacts on terrestrial vegetation can then be made using table 5, which shows that there are 66 acres of bottomland hardwood above Lake Darling Dam between elevations 1590 and 1600, 1,500 acres of marsh, 19 acres of agricultural land, and 289 acres of grassland. Figure 3 shows that these acreages were flooded from flat-pool storage a minimum of about 12 days, from 8 through 20 May during the 1975 flood. Maximum duration of inundation depends upon specific elevation for the habitat. Depths at some locations range up to almost 5 feet at peak storage (elevation 1600.7, normal Lake Darling pool assumed to be 1596 with no "terrestrial" habitat from table 5 below that elevation With the recommended project, flat-pool storage would not have occurred to elevation 1600 (due to greater pre-flood drawdown of Lake Darling). Again using figure 3, terrestrial habitats at elevation 1597 were flooded from flat-pool storage about 34 days from 1 May through 3 June during the 1975 flood; under "modified" conditions the corresponding duration would have been 48 days from 13 June through 31 July. Of course, some of the acreage is flooded by flowing water either with or without the recommended plan.

4.03 Figure 4 presents similar information for the 1976 flood (about an 80-year flood event), and figure 5 for the 0.5 percent chance flood. Those less frequent floods would require storage behind Burlington Dam itself in addition to the Lake Darling storage, (and so figures 4 and 5 have an additional stage hydrograph), but the hydrograph can be interpreted in a similar fashion.

4.04 The analysis in figures 3-5, and on the following pages assumes the release plan set forth in paragraphs 1.14 through 1.22. The release plan is a tradeoff between reducing environmental damages in the pool to a point where the USFWS will accept them, and keeping downstream flows to a point where the Minot channel can convey them and where other downstream interests state they would also desire some flood control benefits.



RESERVOIR STAGE HYDROGRAPHS



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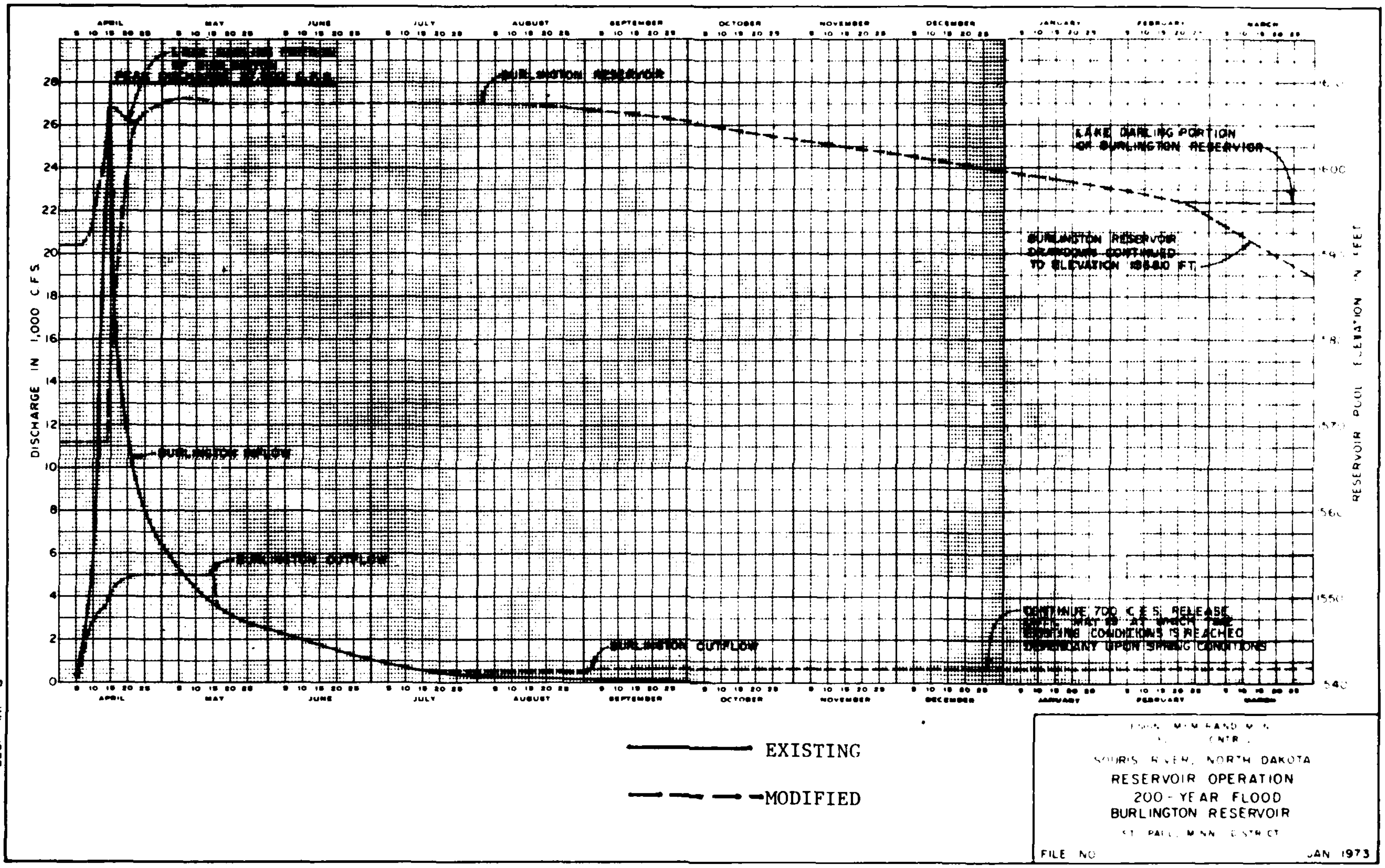

Figure 5 Lake Darling Hydrograph, 0.5-Percent Chance Flood

GEOLOGICAL IMPACTS

4.05 Considerations made in the evaluation of the impact of the project on the geology of the basin include: the stability of the reservoir walls, effect on the groundwater levels adjacent to the reservoir sites, effect on the groundwater levels in the divide between the Des Lacs and Souris Rivers at the diversion tunnel location, effect on the groundwater levels in the floodplain downstream from the reservoirs, channel erosion downstream from the reservoirs, effect on mineral deposits, and effect on unique geologic features.

4.06 Some sheet or rill erosion along the valley slopes due to loss of vegetation after inundation is expected. The erosion is not expected to be severe, however, due to the natural resistance of the soils to erosion and the fact that erosion is normally inhibited by low rainfall and by frozen ground for long periods in the winter. Erosion due to construction activities at the various project sites will be short-term and will be controlled or minimized by proper construction procedures.

4.07 No water would be stored behind Burlington Dam for floods having a probability of annual occurrence greater than 2 percent. In addition to the low frequency of storage, the duration of storage and drawdown rate would not be sufficient to induce more than an occasional, shallow slope failure. Shoreline erosion, which is often conspicuous along permanent reservoirs, would not be a major concern under the proposed plan due to the low frequency and short duration of storage. In the worst conditions, occasional low banks or benches would be etched in the valley slopes if sustained high winds coincided with high pool levels. Utilization of Lake Darling to store floodwater would result in a slight aggravation of the existing erosion apparent around the lake. No significant shoreline erosion would develop in the Des Lacs River valley due to the temporary and intermittent ponding required for diversion of water into the Souris valley.

4.08 The Souris River valley in the Burlington and Lake Darling reservoir areas is carved in a thick, regional deposit of glacial till which is primarily a sandy, stony clay with occasional seams, channels and lenses of sand and gravel. The permeability of the material is very low except in the sandy phases. Therefore, changes in groundwater levels near the valley induced by infrequent storage in the Burlington reservoir would be insignificant due to the length of time required for the water table to adjust to the temporary change in base level. For the same reasons, no perceptible change in groundwater levels would result from the revised operation of Lake Darling Dam or due to diversion of water from the Des Lacs to the Souris valley. No permanent change in the local water table should develop from the construction of the diversion tunnel. Any temporary dewatering required for construction of any of the structures is not expected to have an adverse effect on the availability of groundwater for other demands in the area.

4.09 The effects of the proposed project on the geology of the basin downstream from the Burlington Dam would be restricted to the floodplain area. Except for the times when water would be stored in the reservoirs, the natural discharge of the river would be maintained, and no change in the existing conditions would occur. The exception to this evaluation is in Minot where some of the channel meanders are

cut off with bypass channels. The river in this area is considered to contribute some recharge to deep valley aquifers. The project, however, provides for continued flow through the existing meanders. The channel area available for recharge to underlying aquifers is, therefore, increased slightly, and any recharge from the river increased accordingly.

4.10 During those years when floodwater is stored and later released, above-normal flows in the river downstream from Burlington Dam would be extended over a greater length of time. In the case of the 1-percent flood this condition could extend up to 9 months. Effects on the geology to be considered in these extreme cases are changes in groundwater levels and erosion of the stream channel. For any sustained rise in river level, the groundwater level under the floodplain will also rise and, if given sufficient time, be nearly the same level as the river. Upstream from Verendrye no significant rise in the groundwater level is expected, except following floods near the 1-percent magnitude. Even following these extremely large floods, any adverse rise in the water table would not be expected to exceed one month in April and May because the channel capacity would be adequate to handle the discharges without an excessively high stage. Also, the floodplain sediments upstream from Verendrye are generally silts, clays and fine sands with low permeability which would retard the effect of high river stages on the water table over a large area. Downstream from Verendrye, however, the channel capacity is lower and the floodplain sediments more pervious. Therefore, a high water table in that area during the spring, fall and winter should be expected to accompany discharges made after storage of a major flood.

4.11 Water released from the reservoir would be relatively free of sediment, and the erosive capacity of the water would be greater than that of the sediment-laden natural flows. Channel scour and bank stability are recognized as possible local problems following storage of a major flood. The greatest potential problem area is that portion of the river downstream from Verendrye where the channel would be filled to capacity for sustained periods following a major flood. Although channel erosion and stability are recognized as potential problems, they are not considered critical because of the low frequency of floodwater storage. Also, the problems are not expected to be significantly greater than those experienced under natural conditions during a major flood and would be easier to correct or protect against because of the controlled nature of the flows.

4.12 Economic mineral deposits affected would be restricted to those deposits of sand, gravel, boulders and clay used for the construction of the proposed structures. The projects would not, however, significantly deplete the regional supply of these materials. The projects would have no effect on the production and future development of lignite, oil, gas, or salt.

4.13 No unique geological features would be affected by the project.

PROJECT EFFECTS ON GROUND WATER

4.14 The Souris River Valley, in the areas of the Burlington and Lake Darling Reservoirs, is carved in a thick regional deposit of glacial till which is primarily a sandy, stoney clay with occasional seams, channels, and lenses of sand and gravel. The permeability of the material is very low except in the sandy phases. Therefore, changes in ground water levels near the valley, induced by infrequent storage in the Burlington Reservoir, would be insignificant due to the length of time required for the water table to adjust to the temporary change in base level. For the same reasons, no perceptible change in gound water levels would result from the revised operation of Lake Darling Dam or due to diversion of water from the Des Lacs River to the Souris River. No permanent change in the local water table should develop from the construction of the diversion tunnel.

4.15 Downstream of Burlington Dam, for any sustained rise in river levels, the ground water level under the floodplain will also rise and, if given sufficient time, be nearly the same level as the river. Upstream from Verendrye, no significant rise in the ground water level is expected. Downstream from Verendrye, however, the channel capacity is lower and the floodplain sediments more pervious. Therefore, a high water table in that area during the spring, summer, and fall should be expected to accompany discharges made after storage of a major flood.

4.16 In general, the chemical quality of the ground water in the region varies within wide limits and is usually highly mineralized and, therefore, considered to be of poor quality.

OPEN WATER IMPACTS

4.17 Short-term impacts to the aquatic ecosystem in the Souris and Des Lacs River valleys would be associated with project construction activities, including dam and tunnel constructions, modification of refuge impoundments, proposed Velva Channel Cutoff, and channel and levee construction. These impacts would result from direct physical disruption and, more importantly, from increases in suspended sediments which would bury aquatic invertebrates, irritate exposed membranes of fish and invertebrates (possibly to the extent that secondary bacterial infections could occur), and reduce autotrophic production through a reduction in light penetration. All of these effects will result in a considerable decrease in aquatic production for several years.

4.18 An example of these types of effects was noted by the USFWS below Minot where channel modifications were in progress. Within a 14-mile (river miles 381.5-367.4) reach of the river below Minot, macroinvertebrate populations were severely reduced. Within the next 22-mile reach (to river mile 345.2) considerable recovery had occurred, and by river mile 330.7 (Velva, North Dakota) complete recovery from siltation effects was assumed with an associated increase in the number of of aquatic taxa. This reach was also affected by organic pollution from Minot, and these effects were not completely separable from siltation effects.

4.19 The impacts to the aquatic environment above Lake Darling (Segment I) would, to some degree, depend upon the operating procedures utilized by the USFWS during the lower flows. For the present analysis, it has been assumed that Lake Darling would be drawn down to elevations 1591 to 1594 (see paragraph 1.13) to provide additional flood storage behind Lake Darlng Dam and thus reduce the frequency of storage required behind Burlington Dam. This means that with the 5,000 cfs release plan, Lake Darling would be capable of storing floods up to the 50-year event. With the raise of Lake Darling spillway from 1598 to 1602, the area between elevation 1598 and 1605 in Segment I would be subject to slightly longer periods of inundation for a 50-year flood, with no change in length of inundation of a 25-year flood. This should cause little, if any, effect over existing conditions. The area between 1596 and 1598 could be substantially altered, however, due to plans to hold water at 1598 until fish spawning has been completed. Within the 1596 to 1598 area, stream productivity would probably be reduced due to increased sedimentation, destruction of stream side vegetation and an associated reduction of terrestrial organic food material (allochthonous material), and decreased bank stability.

4.20 The primary aquatic value of this area (1596-1598) above Lake Darling appears to be for spawning of northern pike. By increasing the operational flexibility of Lake Darling, i.e., being able to hold water at 1598 without fear of reduced flood protection for downstream areas, it should be possible to encourage the successful reproduction of northern pike by avoiding too rapid drawdown below elevation 1598 in water levels during spring spawning and hatching periods.

Lake Darling

4.21 The proposed two-dam plan was developed as a trade-off with other dam alternatives as a means for reducing the frequency and extent of adverse impacts (concern is mainly with terrestrial and managed marsh systems) in the area between Lake Darling and Burlington Dam. Adverse impacts are essentially transferred to the area above Lake Darling Dam. The Lake Darling area would be subject to flooding of greater depth and longer duration than under existing conditions.

4.22 Segment II (Lake Darling) would be subjected to storage up to about elevation 1600 for the 25-year flood and 1605 for the 50-year flood, an increase in depth of about 1 and 4 feet, respectively, over existing conditions. As with the upstream reach, the length of storage between 1596 and 1598 (current spillway elevation) would depend on operating procedures for fish and wildlife management. Length of storage would also be increased over existing conditions (about 27 days more at elevation 1600.5 with a 50-year flood). For 1- to 2-percent chance floods, inundation periods would range up to 1 day at 1605.5 to 167 days at 1598.5. For the 200-year event, inundation times would be increased further (up to 251 days at 1598.5), and Burlington Dam would back water over Lake Darling Dam for about 1 month. Except for any drawdown caused by anticipating floods, floods up to the 25-year event should have little effect on Lake Darling, although sedimentation would probably be increased slightly due to erosion from the area between 1599 and 1600.

4.23 Depending upon timing of the flood, spawning success of northern pike could be reduced for larger, less frequent events due to rapid drawdown to 1598. Northern pike prefer to spawn over shallow (e.g., 7 inches) flooded vegetation when water temperatures are between 40° and 52° F. Eggs require about 21 days for hatching, and newly hatched young remain in the area for several more weeks. Drawdown following the flood peak would render much of the presently suitable area above 1598 unsuitable for northern pike spawning. However, flood events greater than a 50-year event are considered rare, i.e., their probability of occurrence in any year is very low. Similarly, it is doubtful that even the complete failure of a particular year class of game fish would seriously affect the Lake Darling and downstream fishery. (Fish habitat impacts and fish kills would be more significant.) The occurrence of large flood events in successive years could, however, cuase a significant impact and would probably require stocking to supplement natural reproduction. It is unknown whether adequate stock would be available.

4.24 In most years (more than 75 percent of the time), however, northern pike spawning should be encouraged due to the capability to hold the water level at 1598 until the fry move off the spawning beds.

4.25 Drawdown and winterkill conditions are areas of concern with the recommended plan. Paragraph 1.13 noted that drawdown in anticipation of floods requiring control would involve drawdown to between elevations 1591 and 1594. Figure 2 shows that drawdown would have been about 2.3 feet lower (to 1591) for the 1975 flood with the recommended plan in place and operating. This may have caused a severe winterkill as in 1966-1967, which had a severe winterkill when the water level was at elevation 1593.6 (see paragraphs 2.73 and 2.136). Whether 1975 would also have been a winterkill year with the recommended

plan in place would depend in part upon how other reservoir conditions (e.g., ice and snow cover) compared in 1967 and 1975. In 1976, in contrast, there would have been little difference in drawdown between the with- and without-Burlington project conditions. Winterkill is of great concern because, unlike loss of a year class due to poor spawning conditions, winterkill results in the loss of several year classes, including the brood stock. Paragraph 2.136 summarized some of the problems in recovering from the 1967 winterkill.

4.26 Holding Lake Darling at elevation 1598 for prolonged periods of time, coupled with inundation to higher elevations, would increase erosion around, and sedimentation in, the reservoir. Although the sedimentation increase is not anticipated to be large, the physical effects of increased sediment deposition in the reservoir and the increase in nutrient loading from ions adsorbed on the sediments would exacerbate the already eutrophic conditions. The EPA's National Eutrophication Survey Report on Lake Darling indicated the possibility of the lake's being nitrogen limited. Since a high percentage (88 percent) of the nitrogen input to the lake is caused by agricultural practices, measures to minimize nitrogen input (time of fertilizer application, land treatment measures, and the like) should be advocated by the Soil Conservation Service and the Water Management Districts. Further degradation of the lake would decrease the value of the existing game fishery and hasten its succession to a panfish/bullhead fishery. Alternating drawdown and flooding is expected to adversely affect plant life, and production of animal food for fish and waterfowl within the littoral zone.

4.27 During years requiring storage behind Burlington Dam itself (less than twice in 100 years on the average), the impacts on the aquatic community between the dam and Lake Darling would be similar to those discussed for upstream reaches. These would include increased siltation, reduction or loss of spawning opportunities for northern pike and walleyes, and reduction of both diversity and numbers of invertebrates. This reach of river, as indicated by the USFWS limnological survey, can be characterized as degraded, with discharges from Lake Darling contributing to the pollution-tolerant character of the species. Because of the infrequent nature of the storage behind Burlington Dam, adverse aquatic impacts are not expected to be great in this reach. Because of the control of frequent flood events provided by the raise of Lake Darling Dam, the controlled release of water would encourage fish spawning and invertebrate populations which might otherwise be adversely affected due to high peak flows under existing conditions. During years with extended releases from Burlington and Lake Darling Dams (greater than 50-year flood), the increased "base" flow would benefit the river environment by eliminating potential severe low flows for those years. (The probability of a large spring flood the same year as a severe summer drought is very small, however.) This increased flow would not significantly enhance the existing river fishery, which is poor, because of its infrequent nature.

4.28 At present, no carp are known to inhabit the Souris River within the United States. The USFWS has expressed concern that the addition of Garrison Diversion Unit return flows would create conditions that would enable carp to enter the Souris River from the Assiniboine River in Canada and overwinter in the marsh impoundments of J. Clark Salyer NWR. Garrison Diversion Unit return flows would reduce the probability of low dissolved oxygen concentrations in the marshes during the winter. During years of extended releases from Burlington Dam, these conditions would also exist with or without the irrigation return flows. However, without Garrison Diversion Unit, the probability of carp introduction in the near future would be low due to the infrequent nature of releases from Burlington extending through the winter (less than 1-percent chance in any year). Should carp become established in the Souris River, Burlington Dam, because of its ability to back water over the top of Lake Darling Dam, would increase the likelihood of carp being introduced into Lake Darling, although if they were able to occupy downstream reaches it would only be a matter of time before they were introduced into Lake Darling even without the assistance of Burlington Dam. This is part of the reason that the recommended plan includes preliminary costs for a high velocity culvert to prevent carp passage during lower flows. There is a need to study the effectiveness of this control, as well as the need for carp control at high flows. The plans for the carp control structure would be developed during the Phase II detailed design studies. Further information on the inplications of carp introduction is found in International Garrison Diversion Study Board (1976) and U.S. Fish and Wildlife Service (1976).

Water Quality Impacts During Construction

4.29 The raising of the Lake Darling Dam and the construction of the Burlington Dam, Des Lacs Diversion tunnel, modification of refuge impoundments, levee and channel modifications, and the channel cutoff near Velva would all result in the temporary degradation of water quality. The most apparent impacts would be increased turbidity due to increases in suspended solids and lowered levels of dissolved oxygen. These impacts are short-term and generally limited to the amount of time required for project construction. Much can be done to minimize these short-term impacts.

4.30 The Corps has developed specific guidelines for protection of the environment, which contractors have to follow; those guidelines specifically relating to water quality are as follows.

a. General. The contractor shall not pollute rivers, streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, insecticides, herbicides, or other harmful materials. The contractor shall investigate and comply with all applicable Federal, State, and local laws and regulations concerning pollution of bodies of water.

b. Erosion Control. Prior to any major construction, the contractor shall submit a plan showing the contractor's scheme for controlling erosion and disposing of wastes.

c. Surface drainage from cuts and fills within the construction limits, whether completed or not, and from borrow and waste disposal areas, shall, if turbidity-producing materials are present, be held in suitable sedimentation ponds or shall be graded to control erosion within acceptable limits. Temporary erosion and sediment control measures such as berms, dikes, drains, immediate seeding of cut and fill slopes, or sedimentation basins, as required, shall be provided and maintained until permanent drainage and erosion control facilities are completed and operative. The area of bare soil exposed at any one time by construction operations should be held to a minimum. Stream crossings by fording with equipment shall be limited so as to control turbidity. Temporary culverts or bridge structures shall be removed upon completion of the project. Fills and waste areas shall be constructed by selective placement to eliminate silts or clays on the surface that could erode and contaminate adjacent bodies of water.

d. Spillages. Special measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides, insecticides, and concrete drainage from entering public waters.

e. Washing and Curing Water. Water used in embankment material processing, aggregate processing, concrete curing, foundation and concrete lift cleanup, and other waste waters shall not be allowed to re-enter the river if a significant increase in the turbidity of the river could result therefrom. The contractor shall remove from within the cofferdam all wash, curing, and waste waters derived from sources either within or outside the cofferdam.

f. Cofferdam And Diversion Operations. The contractor shall plan operations and perform all work necessary so as to minimize increase in turbidity of the waterway during required construction.

g. Disposal. Disposal of materials, wastes, effluents, trash, garbage, oil, grease, and chemicals in areas adjacent to streams will not be permitted. If any waste material is dumped in unauthorized areas, the contractor shall remove the material and restore the area to the original condition before being disturbed. As directed, contaminated ground shall be excavated, disposed of, and replaced with suitable fill material; compacted and finished with topsoil; and planted as required to re-establish vegetation.

Water Quality Impacts of Impounding Water Behind Burlington Dam

4.31 When storage is required in Burlington Reservoir for flood control, water quality of the Souris River will be affected. Some of the impoundment characteristics which will affect water quality are storage volumes, depths in reservoir, orientation to prevailing wind direction, retention time, character of the underlying soils, upstream conditions in Lake Darling, and the nature and extent of vegetation in the impoundment. The land areas and types which would be inundated by the Burlington Reservoir at various elevations are shown in table 5.

4.32 Present methods are not sufficiently advanced to determine all of the effects of the temporary impoundment of water behind the Burlington Dam. The assessment of these impacts is based upon professional judgment and is the best estimate that can be made as to actual effects of storing water behind the dam. However, some of the significant physical, biological, and chemical relationships affecting water quality can be considered. A study by Sylvester and Seabloom (1965) lists the processes by which impounded water may have its quality altered when in contact with soil and vegetation. These processes are as follows.

a. Ion exchange through the clay and humic colloids in the soil under water-saturated conditions.

b. Microbiologic degradation of organic materials which release dissolved materials and carbon dioxide, which increases the solubility of certain minerals and organic residues.

c. Leaching of organic and mineral substances from the soil or vegetation, which may support algal growth and a production of additional organic matter with added products of decomposition.

d. Microbiologic activity at the soil/water interface, which depletes the dissolved oxygen, possibly causing anaerobisis and a change in the products of decomposition.

4.33 Dissolved oxygen concentrations in the waters impounded behind Burlington Dam and in downstream releases are probably the most important parameters to be considered. These concentrations will be primarily influenced by the oxygen demand of the decaying vegetation in the reservoir and the organic content of the soils. Data from Sylvester and Seabloom's study listing relative oxygen demand which may be expected for various soil and plant types are shown in table 19.

4.34 Woodlands constitute about 10 percent of the area of the Burlington pool below the 100-year frequency pool elevation. Wood has a very complex chemical composition but is composed primarily of cellulose, hemicellulose, and lignin. This material, while rich in carbon, is deficient in nutrients, especially nitrogen which is needed for rapid decomposition. The lignin is quite resistant to biological decomposition. Principal effects caused by woody material would be increased chemical oxygen demand and darkened color of the water. Rotting logs and stumps would have a more deleterious effect than the growing timber. A program to remove fallen timber from the reservoir on a periodic basis would be a workable measure to reduce adverse effects of an inundated woodland on water quality.

TABLE 19: BIOCHEMICAL OXYGEN DEMAND (BOD) - SOIL AND PLANT MATERIAL

Sample Description	Organic Matter By Dry Weight (Percent)	3-Day BOD mg/l/g	7-Day BOD mg/l/g	15-Day BOD mg/l/g
Organic muck soil	30	1.6	2.3	3.7
Swamp organic (peaty)	73	3.8		
Silt loam sediments	9	.16	.22	.40
Gravel loam with wood fragments	17	.24	.42	.60
Swamp litter	80	3.0	4.6	8.2
Pasture loam with dead grass	20	10.0	15.8	
Forest litter: ferns and maple leaves	--	7.9	---	---

4.35 Wetlands, grasslands, and agricultural lands constitute the major portion of the lands that would be inundated and would have the bulk of organic growth which would adversely affect water quality. The swamps and wetlands which are maintained for wildlife in the reservoir area probably have the greatest organic content per unit area. This vegetation and other herbage, including twigs and leaves, have a large exposed surface area when compared to that of the soils. It is believed that these materials would cause more oxygen depletion than the organic soils.

4.36 Approximately 75 percent or more of green plant tissue is water, while the structural tissues are composed of some 11 percent oxygen, 2 percent hydrogen, and 2 percent ash. This ash contains nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur, as well as many other trace elements required for plant growth. Table 20 summarizes the composition of some selected plant materials with respect to these nutrient elements.

TABLE 20: CONCENTRATION OF SOME MINERAL ELEMENTS IN DRIED CROP PLANT TISSUE

Element	Unit	Alfalfa	Barley Straw	Oat Straw
P	Percent of dry weight	.1-.5	.04-.6	.02-.04
K	Percent of dry weight	.5-4.6	1.1-2.0	.6-3.6
Ca	Percent of dry weight	.5-4.6	----	.15-.7
Mg	Percent of dry weight	.2-.4	----	.06-.5
S	Percent of dry weight	.2	.08-.2	.09-.5
Fe	ppm	130-1000	----	60-370
Mn	ppm	10-120	7	4-1660
Cu	ppm	4-15	----	3-54
Zn	ppm	14-110	----	4-200
B	ppm	3-4	----	-----

4.37 The decomposition of aquatic plants from the standpoint of dissolved oxygen requirements and the release of nitrogen and phosphorus compounds were investigated by Jewell (1971). The rate of decomposition for these materials averaged about 9 percent per day with wide variations. Decomposition was essentially complete by the 90th day, and approximately 24 percent of the initial organic material was found to be refractory. General increases in phosphorus and nitrogen concentrations in the water were noted, along with initial lowering of pH and the production of carbon dioxide. It was also noted that the color of the water had darkened.

4.38 Although it is impossible to predict decay rates and total effects of the decay of vegetation in the impoundment, it is thought that the vegetation would cause: (1) greater adverse effect than the underlying soils; (2) darkening of the water color; (3) release of nutrients; and (4) oxygen demand from decaying vegetation. Also, the organic soils would probably create anoxic conditions at the soil/water interface. Low dissolved oxygen concentrations are not expected throughout the entire water column because the reservoir is unlikely to stratify. The morphometry of the Burlington pool is similiar to that of Lake Darling, which does not stratify.

4.39 Algal growth in Lake Darling has been significant on occasion. Increased nutrient release from the soils and decaying vegetation in the Burlington Reservoir, plus the "seed" effect from Lake Darling, will result in algal growth in the reservoir. Phytoplankton blooms could occur, but it is thought to be unlikely because of the relatively short residence time. Filling and emptying of the Burlington pool for the 100-year frequency flood is estimated to be about 270 days. Lake Darling has a mean hydraulic retention time of about 1.4 years.

4.40 The following table contains a subjective listing of some of the impacts that the Burlington Dam could have on the water quality of the Souris River. Where applicable, these impacts are assumed to compare with average flow conditions in the Souris River during the late summer and early fall period.

TABLE 21

IMPACTS OF BURLINGTON DAM ON WATER QUALITY
IN THE SOURIS RIVER

Item (1)	In Reservoir (2)	Downstream (3)
Nutrients	Slight increase	-
Dissolved solids	Little change	Probable decrease because release waters will normally be that from spring runoff period which has lower dissolved solids.
Color	Slight increase	-
Ammonia	Increase but not to toxic levels	-
Phytoplankton	Growth but not to nuisance levels	-
Temperature	-	Slight decrease primarily due to higher flow rates.
Dissolved oxygen	Anoxic at soil-water interface to near saturation at surface	Minimum 85 percent saturation because of reaeration by outlet works.
Assimilative capacity	Little change	Moderate increase primarily due to higher flow releases. For all practical purposes, the Souris River has no assimilative capacity for any continuous loading with or without Burlington Dam.

Effect of Diversion of Des Lacs River Water to the Souris River

4.41 Diversion of Des Lacs River waters would begin when the discharge from the Des Lacs River reaches 1,400 cfs, equivalent to a flood having about a 14 percent chance of occurring in any one year. Normally, this diversion would occur during spring runoff when the water quality in both rivers is generally considered to be better than during low inflow conditions. Therefore, it is thought that this diversion would not significantly change water quality conditions in the Souris River.

4.42 Additional information on water quality impacts is contained in the July 1977 Supplement Number 1 to Design Memorandum Number 1, Hydrology and Hydraulics Analysis, Corps of Engineers, St. Paul District.

TERRESTRIAL VEGETATION IMPACTS

4.43 Major flood control reservoirs typically exhibit dramatic effects upon terrestrial vegetation, and the Burlington project would be no exception. This conclusion is based upon the literature and upon observations of flood control reservoirs in the northeastern United States and the Upper Midwest. The reservoirs studied exhibit a wide range of characteristics, from great depths (e.g., 50-100 feet) of floodwater storage to small depths, from long durations of storage (e.g., from snowmelt until late August and late September) to floodwater storage of only about a week, from prairie to near-boreal forest conditions, from dry dams to wet dams with small to very large "permanent" pools, from a few tens of acres in the flood and/or "permanent" pools to many tens of thousands of acres, from watershed conditions which allow several hundreds of acre-feet of sedimentation during even the more frequent floods to conditions allowing only a thin deposition of sediment during flood events, etc. There are also a number of studies of other vegetation-flooding relationships which are pertinent, e.g., vegetation damage behind beaver dams and natural river flooding effects upon bottomland hardwoods in the southern United States. None of the situations studied are like Burlington Dam in all the key characteristics. There are also no published review articles which compare all these different conditions and present some sort of model which could be used to predict the effects of Burlington Dam on vegetation. Furthermore, most studies have related vegetation damage only to duration and/or depth of flooding, while observations indicate that topographic conditions, frequency of storage, slackwater versus flowing water, vegetation health and maturity, phenology, and a host of other factors also dictate the degree to which vegetation will be damaged. The following paragraphs, therefore, contain only a few semi-quantitative predictions as to vegetation damage from Burlington Dam. In most cases, they represent best judgment based on the above. Predictions at other reservoirs would generally be different.

Grassland

4.44 Acreage of grassland within areas of impact is presented in table 5. There are approximately 1,453 acres of grassland, grazed and ungrazed, between Burlington and Lake Darling below elevation 1605. Between elevations 1605 and 1620 there are another 615 acres. Most of the grassland between Burlington and Baker Bridge is pastured or hayed, and above Baker Bridge is reserved for wildlife. Grasslands comprise a large portion of the 350 acres in the Des Lacs valley which would be inundated during diversion.

4.45 Floodwater storage of even a few days during the growing season would be sufficient to kill the grassland sod. This is most apparent in areas of upland grassland types (of both native and introduced species), as opposed to grass or graminoid types which are more adapted to wet conditions. In the grassland communities, the uppermost limit of floodwater storage during any given flood event would be marked by a rather distinct line which is caused by flood-deposited debris and a conspicuous growth of taller weeds. In one observed case, the weedy growth has persisted for a few years since floodwater storage, is dominated by the thistles Sonchus and especially Cirsium, and appears rather stable and persistent.

4.46 The thistle-dominated zone of maximum floodwater storage would be most vigorous at its upper edge, hence its sharp demarcation from grassland undisturbed by floodwater storage and its value (even without accompanying debris) in marking the zone of maximum storage. The thistle-dominated zone would attenuate within a couple of vertical yards to a zone which is more typified by bare ground and/or subsoil (at least until some plant litter reappears) which has a relatively sparse growth of early successional "weeds" typical of xeric conditions (even in regions of climates of fairly favorable evapo-transpiration conditions; the tendency toward xeric weed communities would be greater in North Dakota). Below the sparse-growth, bare soil zone would be a zone of subsoil with some woody debris and with some weeds, where conditions of microclimate and sustained seed retention in the subsoil allow (e.g., behind driftwood). Below the zone would be mostly bare subsoil. These more drastic changes would be permanent for practical purposes.

4.47 This generalized profile from the literature and observations at existing reservoirs would be applicable at all the Burlington pool area side slopes following floodwater storage. Surprisingly, there is little difference (based on observations at existing projects) between sites having an "effective fetch" of as little as 100 feet. In either case, the sod is heavily damaged and resultant weedy plant communities are similar, other factors such as topography allowing.

4.48 The permanence of these vegetational effects on valley side slopes is of interest in evaluating impacts. There are no documented, directly applicable studies on this problem. However, observations at existing reservoirs suggest that the thistle-dominated zone may recover in large part within a decade or so due to retention of the upper soil horizons and due to competition/succession. Range ecology studies of similar plant communities could perhaps refine this estimate. For the areas below the thistle-dominated zone, damage to the sod and upper soil horizons would be sufficient to set the sites back to something akin to primary succession. Given the time spans involved in succession on severely degraded grassland, and given the apparent great length of time to develop a typical prairie soil profile, complete recovery from a major flood event may never occur before the next flood, even for extremely rare floods in the upper part of the pool area. Cultural practices could of course be used to advance recovery (or to provide another desirable plant community such as "dense nesting cover"), but such efforts are not programmed nor would they provide all the attributes of the original plant community.

4.49 Along the relatively flat valley bottom, the existing grassland community would be killed; but edaphic and slope-erosion characteristics are such that post-flood terrestrial plant growth could be profuse (in contrast to slope areas; see the section on weed control which follows). However, in areas of more frequent water-level fluctuation and sediment deposition, the substrate would be a mudflat with cracks from drying and with sparse seedlings of annual weeds, but perhaps more typically growths of "terrestrial" algal species in wet areas. The mudflat condition would persist for a few years, depending upon sedimentation-frequency of storage characteristics, as well as the physical effects of drying and freezing. Even when moisture is adequate, other physical conditions may forestall succession. Of course, cultural practices could again be used.

Agricultural Lands

4.50 The majority of the impacted agricultural land between Burlington and Lake Darling lies on the valley floor below elevation 1605 (table 5). Upstream of Lake Darling it is essentially equally distributed among the 10-foot contour intervals between elevation 1600 and 1620.

4.51 The USDA Soil Conservation Service (SCS) has indicated that much of the valley floor is considered "prime" farmland, i.e., the land's value derives from its general advantage as cropland due to soil and water conditions. The SCS also indicated that no "unique" farmlands, those whose value derives from their particular advantages for growing specialty crops, have been identified in the area. The major portion of the "prime" farmlands is located within the Upper Souris NWR and upstream of the refuge. (See exhibit 2 , letter from Soil Conservation Service.)

4.52 Above Burlington, about half the agricultural area is used for small grains, and half is pasture and hay (including alfalfa). Not all the land used for grain is cultivated every year. One-third of the cropland is typically left fallow each year. A typical rotation pattern might be: first year, wheat; second year, fallow; third year, oats; ect. Cropland inundated for one growing season could reasonably be expected to be reestablished in a monocultural crop in 1 to 3 years, depending on the crop. Production would be lost the year of inundation. Production losses for the following years would probably depend on the crop and would range from light to heavy. For example, if the crop grown were a small grain, the crop would be lost during the year of the flood, and the following year the land could be tilled and the crop grown (any soil damage or problems with flood-deposited debris not considered). If the crop were a tame hay such as an alfalfa-brome mixture, the crop would be lost during the year of the flood. The following year the land would need to be cleared of debris, possibly "planed," plowed, tilled, and reseeded to an alfalfa-brome mixture. It would take at least one growing season for the crop to become firmly established before cropping could take place, and it therefore would be in the third year at the earliest that the landowner would be able to harvest a hay crop from the land. In all situations, it would be necessary to remove some of the larger woody debris before tilling. Future cultural practices may require more extensive fertilization, weeding, and tilling because of inundation, soil damage, and introduction of more weeds. See also table 5, which shows the frequency of inundation for agricultural land and other habitat types.

Bottomland Hardwoods

4.53 Of the approximately 900 acres of bottomland hardwoods located within the design flood pool above Lake Darling Dam, about one-third would be destroyed or seriously damaged due to the increased elevation and duration of storage behind Lake Darling Dam for floods of the 100-year magnitude. After storage of a 100-year flood, msot of the vegetation below perhaps elevation 1601 would be expected to die from prolonged inundation, and some damage would occur above that level. The entire forest herbaceous layer under perhaps elevation 1604, comprising the wildflowers and other herbs and grasses, would be eliminated. Much depends upon factors such as phenology, timing of the flood, and topographic position. Storage of the 50-year flood would probably not result in significant damage to bottomland hardwoods in the area above Lake Darling since durations are increased only a maximum of 4 days (Segment I) and little bottomland hardwood exists within the Lake Darling area (Segment II).

4.54 When storage would be required within the Burlington Dam to Lake Darling Dam area (for greater than a 50-year event), inundation for more than 5 months would result in the destruction of the more the 450 acres of floodplain forest. Damage to the stream bank forest would in turn cause damage to the stream because much of the productivity of the stream is dependent upon the riparian forest for shade, habitat, and inputs of organic material. Essentially all of the vegetation would be killed under such circumstances. It should be noted that the approximately 1,400 acres of bottomland hardwoods within the flood pool of the proposed reservoir represent about 0.4 percent of the State total of 400,000 acres and about 1.4 percent of the acres outside the Pembina Hills and Turtle Mountain areas.

4.55 Some reestablishment of woody vegetation would occur, but of a type quite different from the existing flooplain forest. Resprouting and suckering from roots or root collars (like after logging) would be of no significance because the underground plant parts are generally killed first by floodwater storage of long duration. Reestablishment from tree seed would be sporadic, due to changed edaphic conditions and to lesser availability of tree seed once the local floodplain forest is killed. Where conditions allow (e.g., soils not water-logged for long periods, soils otherwise not chemically or physically altered, or the upper soil horizons not removed after the vegetation dies), the general pattern might be the growth of dense scattered thickets of willow and cottonwood. An herbaceous and shrubby understory is essentially lacking in such stands. The stands would persist until the next equivalent flood storage, when many of them would die. In a few scattered spots, individuals of the regrowth could survive the next flood, provided their canopies are not inundated and roots are not killed. Trees surviving inundation may be damaged or killed by wind-driven debris or ice, however.

4.56 In some cases, only portions of the roots and crowns of existing trees would be killed, but the weakened trees would thereby be subject to an earlier death in later years.

4.57 There may be some opportunity to plant new trees in the impacted areas, but this concept is most useful for reservoirs having storage which is not of great depth and, especially, duration. In such cases, the more successful plantings involve large specimens of several inches in trunk diameter. At Burlington, the plantings would generally last only until the next flood of similar or larger magnitude because of the long durations of storage. Herbaceous and shrubby plantings would seem more practical due to more rapid regrowth. Tree plantings may be practical at higher elevations within the pool, however.

4.58 Although the raise of Lake Darling is designed to reduce the frequency of flood storage behind Burlington Dam to less than an average of twice in 100 years, there would be little reduction during most years in existing inundation within the floodplain between Lake Darling and Burlington Dams because the reservoir operation is not planned to control the smaller floods.

Weed Control

4.59 With the death or substantial disturbance of terrestrial plant communities from floodwater storage, conditions suited to weedy species would prevail. Studies at flood control reservoirs in Iowa and North and South Dakota have revealed a general pattern of death of desirable perennial vegetation followed by a great increase in annual weedy species on all but the most severe sites (Stanley and Hoffman 1974, 1975; Wilson and Landers 1973; and personal observations).

4.60 The studies by Stanley and Hoffman at Lakes Oahe and Sakakawea on the Missouri River showed the projects to encourage three species listed as noxious weeds under North Dakota law (Mitich, undated). These were field bindweed (Convolvulus arvensis) which covered 1 to 9 percent of Stanley and Hoffman's sample plots in the weedy floodwater storage zone around the reservoirs, field pennycress (Thlaspi arvense) at 2 to 6 percent, and Absinth wormwood (Artemisia absinthium) at less than 0.5 percent. Other weeds found in the Lakes Oahe and Sakakawea study area were:

Rumex crispus	Dock
Lactuca scoriola	Prickly Lettuce
Kochia scoparia	Kochia, Mexican fireweed
Helianthus annuus	Annual Sunflower
Ambrosia trifida	Giant Ragweed
Salsola kali	Russian Thistle
Polygonum erectum	Erect knotweed
Chenopodium album	Lambsquarters
Polygonum convolvulus	Wild Buckwheat
Grindelia squarrosa	Gumweed
Rosa arkansana	Wild Rose
Ambrosia artemisifolia	Ragweed
Euphorbia esula	Leafy Spurge

None of the species on this latter list are covered by North Dakota's weed laws, but they are on the list of those species which are considered for lower scoring in North Dakota crop judging contests (Mitich, undated). At reservoirs elsewhere in the Midwest, other weeds such as Canada thistle (Cirsium arvense) (which is on the North Dakota list), pigweed (Amaranthus sp.), velvet leaf (Abutilon theophrasti), tickseed (Bidens sp.), foxtail barley (Hordeum jubatum), horseweed (Conyza canadensis), and cocklebur (Xanthium sp.) sometimes become quite common.

4.61 While it is not possible to predict the exact weed species or the amounts which would be present at the proposed reservoir, Burlington Dam would create a weed problem. This could cause difficulties for farmers in the area who would fear that their fields would become infested with weeds. The likely result is that a weed control program would be required on project lands. The Corps of Engineers has programmed funds for this activity, and it seems likely the U.S. Fish and Wildlife Service would also have to conduct a weed control program on their lands on the Upper Souris NWR. Of course, weed control on any lands on which there is only a flooding easement would remain the responsibility of the private landowner. It is also possible that farmers on lands near the flood storage area may become more active in weed control to provide what they may feel is a needed margin of safety.

Wetlands

4.62 Approximately 1,500 acres of wetlands in segments I and II (including the vegetated fringe around Lake Darling) would be subjected to increased flood storage, while floods requiring storage behind Burlington Dam would inundate approximately 3,600 acres of natural and managed marsh in segments III and IV for almost an entire growing season. About 2,200 acres of marsh impoundments are located on the Upper Souris NWR, and over 1,600 acres below Lake Darling.

4.63 Although wetlands are a semi-aquatic plant community and subject to less drastic changes than terrestrial communities, damage would be significant there also. In many areas floodwater storage would kill both emergent and submergent, perennial and annual, rooted aquatic plants through reduced light transmission, removal of contact with air, etc. Recovery could take place over a few years, particularly in the managed marsh units on the Upper Souris NWR which could be drawn down to allow the germination of desirable perennial emergents. How such a program would jibe with the existing program of marsh management through water level manipulation would depend upon the refuge program at the time. In general, there would be conflict due to the refuge having pools in various states of flooding at any one time. (After project operation, all pools would be in the initial successional stage at the same time.)

4.64 There would probably be some lasting effects in the wetlands, however. One possibility is that of a shift in species composition, even with management. For example, cattails could come back as the more vigorous *Typha angustifolia* or *T. X. glauca*, instead of *T. latifolia* which seems more prevalent at present. The two former taxa are very aggressive and rapid in response to greatly disturbed conditions, but seem quite competitive and stable, once established. The significance of this change is difficult to assess; however, dense stands of cattails are already a management problem on some parts of the Upper Souris NWR. Another possibility relates to observations at an Iowa reservoir where small clumps of arrowleaf (*Sagittaria* sp.) have been present for a number of years after flood storage, but they have not yet become as common

as the less desirable species of Carex, Polygonum, Cyperus, etc. Perhaps the significant accumulation of sediment and trash at the Iowa reservoir has caused a long-term adverse shift in suitability of the site for the more desirable species of aquatics such as arrowleaf.

4.65 The fringe of emergent vegetation around Lake Darling which is also an important marsh habitat would be subject to damage due to fluctuating water levels, increased depth and duration of flooding, and increased ice damage.

Other Impacts to Vegetation

4.66 The project between Burlington and Minot includes installation of interior drainage facilities at leveed areas, upgrading existing levees in seven developed areas to current engineering standards, and construction of five channel cutoffs. This would be done to protect the urban floodplain developments between Minot and Burlington from flows up to 5,000 cfs. The levees at Sawyer and Velva would also be upgraded.

4.67 The environmental impacts of the levee work include the removal of some trees and vegetation as necessary to broaden the base of the existing levees and to extend the levees to where they would tie into high ground. Levee heights would be adjusted to provide freeboard over the design flows at the levee locations; generally, this would require lowering of the levees. In two areas where the levee encroaches on the channel, and where landward levee widening is not possible because of residential development, the channel would be widened on the opposite bank to permit widening of the levee on the riverward side. Trees along approximately 3,000 feet of channel in these two areas would be removed and the riverbanks stabilized with rock fill. In channel cutoff areas, trees would be removed from an area of about 25 to 30 acres. The excavated cutoffs would be topsoiled and seeded and channel barrier structures installed to prevent low flows from passing through the cutoffs. All excavated material would be placed on lands determined by local interests to cause minimal damage to their activities. Other adverse impacts of the proposed levee and channel works would include the elimination of trees along the channel banks to permit maneuvering of construction equipment, increased erosion and stream turbidity during project construction, and the prevention of floodplain vegetation nourishment in leveed areas. (Studies in Minnesota and along the Missouri River mainstem show that decreased flooding would reduce the growth of floodplain trees. There would also be an increased growth of brush and other perennial understory plants.) The adverse environmental impacts of the interior drainage works would be limited to those impacts resulting from the construction of drainage ditches, pumping stations, and storm sewers in leveed areas. Impacts would occur from elimination of major natural flooding in abandoned river oxbow areas and other depressed areas behind the levee during floods. These areas may be used as temporary ponding areas during floods, and it would be necessary to

close the storm sewer outlets leading into the river and to pump the interior runoff and seepage water collecting in these areas through discharge lines passing through the line of protection. Of the approximately 1,750 acres in the 100-year floodplain between Burlington and Minot, approximately 550 developed acres would be protected by the proposed levees.

4.68 The impacts of the Minot channel project itself are discussed in the final EIS for that project. Some of the impacts have been mitigated, but other mitigatory actions have not been accomplished.

4.69 With the operating plan for Burlington Dam, about 1,000-1,800 acres of farmland would be subject to extended flooding for those flood events requiring prolonged summer releases from the dam. This acreage would be primarily in the reach from north of Towner to J. Clark Salyer NWR. Flooding easements would be taken on these lands to insure that the reservoir design outflows can be released. Some measures, structural or nonstructural, would also be taken at 112 homes.

4.70 The control of floods with a peak discharge greater than 5,000 cfs at Minot is estimated to result in the conversion of 1,000 acres of agricultural land to urban use. The lands are in scattered areas between Burlington and Logan, but outside of Minot, where areas previously in the 1-percent chance floodplain would now be outside the 5,000 cfs outline, and hence more developable. It is also possible that reduced flooding could result in conversion of natural habitats into agricultural benefits from the project are very slight, however, and an acreage of natural-to-agricultural conversion has not been recognized in the analysis.

4.71 The overall project for the Souris River would decrease the effect of peak flood flows upon the downstream terrestrial ecosytems. The area flooded and the frequency of peak flooding would be reduced, producing a somewhat drier condition (at least along the outer fringe of the floodplain) allowing for encroachment of more xeric species (trees, brush and herbs) than were there before. The growth rate of the floodplain tree species on the fringe would be reduced, based on studies in Minnesota and along the Missouri River.

Impacts to Threatened and Endangered Plants

4.72 As mentioned in paragraph 2.118 the Federal Register dated 16 July 1976 has been consulted, and no known species of threatened or endangered plants would be affected by the proposed project.

WILDLIFE

4.73 Fishery implications of carp introduction to the United States portion of the Souris River basin were discussed earlier. The following paragraphs discuss the wildlife implications of carp introduction. Carp introduction to the three NWR's on the Souris Loop caused by Burlington Dam is of concern because of the impact of carp on waterfowl habitat. Carp directly impact waterfowl habitat by uprooting aquatic plants used for food, cover and/or nesting. They also increase turbidity and act as nutrient pumps (encouraging planktonic algae), both of which further act against flowering aquatic plants. These effects spread through the food chain through adverse effects upon populations of certain invertebrates.

4.74 The severely adverse effects of carp upon waterfowl habitat are well documented in the literature and have resulted in management practices (which in turn have detrimental side effects) aimed at controlling carp. Examples are provision for winterkill which also kills many other fish species (and indirectly affects fish-eating birds) and provision of fish barriers which prevent carp passage, but also the passage of desirable species.

4.75 It has been observed that once carp are introduced into a river basin, they frequently are found and cause adverse effects even in potholes having a history of winterkill conditions as well as the most ephemeral connection to the main waterway.

4.76 Effects of carp introduction, as applied in International Garrison Diversion Study Board (1976) to the Souris Loop refuges, are shown as waterfowl production losses in table 22.

Table 22: Effects of carp introduction on waterfowl populations at three NWRs in North Dakota

NWR	Adults[2] (Fall)	Production	Total	Estimated annual waterfowl population loss Least	Most likely	Greatest
J. Clark Salyer[1]	10,800	15,000	25,800	6,450 (25%)	10,300 (40%)	16,800 (65%)
Upper Souris and Des Lacs[1]	9,300	13,000	22,300	- (0%)	3,300 (15%)	5,600 (25%)
Totals	20,100	28,000	48,100	6,450	13,600	22,400

1 FWS (1960-74).

2 Adapted from IGDSB (1976). Note that the base numbers differ somewhat from those in paragraph 4.77 of this EIS.

4.77 The International Garrison Diversion Study Board report did not estimate waterfowl losses from carp introduction on non-refuge lands. Given the large acreage of waterfowl habitat not within the refuges, this additional loss would also be large. International Garrison Diversion Study Board (1976) also deals with effects upon the northward flight of ducks into Manitoba each year (about 80 percent of North Dakota's fall waterfowl population). Applying their percentage losses to table 18 leads to the conclusion that Burlington Dam without effective carp control at the Manitoba border would: (1) Reduce the fall population of ducks in Manitoba by about 48,000 birds; (2) Reduce the Manitoba waterfowl harvest by about 9,600 birds annually, or about 3 percent of Manitoba's waterfowl harvest; (3) Reduce the Manitoba flight and harvest in subsequent years due to the reduced North Dakota capability as a breeding reservoir, as adjusted for the waterfowl pioneering rate; (4) Probably reduce at least the harvest (and perhaps the production) in Minnesota, Saskatchewan and Alberta (Langowski and Jessen (1975) in IGDSB (1976) reported 27 percent of out-of-State mallards harvested in Minnesota originate in Manitoba and 10 percent in North Dakota); and (5) Reduce the fall flight and perhaps reproduction within the other States and Provinces along the affected waterfowl flyways. This is part of the reason that the recommended plan includes preliminary costs for a high velocity culvert to prevent carp passage during lower flows. There is a need to study the effectiveness of this control, as well as the need for carp control at higher flows. Even if carp control is effective and there are no waterfowl losses due to that cause, Burlington Dam would cause significant waterfowl losses due to habitat damages. Habitat damages were outlined earlier under terrestrial vegetation impacts. Damage to the marsh and grassland habitat types would be of most concern, but the other habitat types also sustain some waterfowl production.

4.78 Impacts of floodwater storage upon terrestrial wildlife would be severe. The response of deer, rabbits, and other small mammals to the resulting damage to the woodland habitat would be a decline in population density in some proportion to the severity of flooding and inundation. The immediate response to inundation would be to move to high ground. Small mammals forced out of their protective shelter would be subject to greater predation and stress factors which would reduce the population size to conform with available habitat. Floodplain forests in this North Dakota region are estimated to support breeding songbird populations ranging from 100 pairs to 500 pairs per 100 acres of floodplain forest. This could translate into a loss ranging from 1,000 to 5,000 breeding pairs in the reservoir area for the year of the flood with effects into the future. Production in following years would be reduced or eliminated because of habitat damage. White-tailed deer, because of their importance to recreation as an intensively managed game species, are of special concern in this regard. Immediate effects of an approximate 50- to 75-year flood would include severe stress upon the deer herd due to loss of browse and cover. With most floods of this magnitude, the deer would be forced to leave the shelter of the valley somewhat prematurely, before the last of the severe weather had broken. Of more concern would be the

long-term effects upon habitat. Damage to deer habitat is a major problem because the valley functions as a wintering area for deer from the surrounding uplands also. Much of this value would be lost, and the project would have more than a local effect upon the deer herd. However, with large numbers of old dead trees existing after inundation (if they are not cut), the nesting areas for cavity-nesting species and other species which depend upon dead trees would be increased.

4.79 Other prominent wildlife which would be affected by flooding of wetlands (and carp introduction, if control is not effective) include muskrat, beaver, and mink. The flooding of marshes would cause these animals to be displaced from their natural cover or dens and to be separated from their natural food sources. Mortality of both adults and young would increase during such circumstances. Long-term habitat effects would greatly affect recovery.

Impacts on Threatened and Endangered Species

4.80 The 14 July 1977 Federal Register has been consulted. The only known adverse effect to threatened and endangered species would be that the Upper Souris NWR would be less suitable as habitat for the Arctic peregrine falcon and the northern bald eagle (proposed as endangered in the 12 July 1976 Federal Register). This area is not designated "critical habitat" for either species, and it is unlikely it could become so. There are several other species which are locally and regionally unusual or rare (such as the wood duck) which would sustain habitat, and resultant population, losses.

Disease Vectors

4.81 Water impoundment projects commonly result in increased mosquito production. This is of particular concern with regard to the mosquito *Culex tarsalis*, which is the most important vector of Western encephalitis viruses, as was the case in the 1975 Western encephalitis epidemic in North Dakota. Although considerable mosquito breeding habitat already exists due to public and private water development projects along the Souris River, Burlington Dam through its storage and prolonged releases would increase mosquito breeding capability. The 1975 epidemic was associated with an uncontrolled flood. The Burlington project with its water storage and releases would to a greater extent confine the water (and potential mosquito habitat) behind the dam and in the locales which are wetter as a result of reservoir releases. However, the duration (and thus potential human exposure to mosquitoes) would be lengthened to include much or all of the summer after a large flood. The results is that areas protected by levees and channels should have a lesser mosquito problem, while the Burlington pool area and other isolated rural areas would have a greater mosquito problem. Although project operation would be infrequent, this would not lessen any occasional public health consequences. In fact the low frequency may have a detrimental effect since the responsible agencies may not have the recent experience and plans to effectively respond to any problem which developed.

4.82 Using workers from the pool of unemployed semi-skilled and unskilled manpower to construct project structures would temporarily alleviate an unemployment problem.

4.83 Total employment in Ward County decreased slightly from 1960 to 1970, while an increase was shown for the city of Minot. In 1972 Ward and Renville Counties, the two counties that would be most affected by the flood control project, became qualified for assistance as economically depressed areas under Title IV of the Public Works and Economic Development Act, according to the regional office of the Economic Development Administration, U.S. Department of Commerce, located in Denver. At the present time, however, only Renville County is still qualified for Title IV assistance. The unemployment figure was 6.5 for Ward County in April 1977. It might be expected that many of the unemployed workers in the area would seek employment connected with the construction of the project.

4.84 In the calculation of special benefits from use of unemployed or underemployed resources, the Principles & Standards (P&S) specifies the necessary criteria for inclusion. "Where the planning region has been designated as having unemployed or underemployed labor resources and it can be shown that these labor resources will in fact be employed or more effectively employed in construction or installation of the plan, the net additional payments to the unemployed and underemployed labor resources should be measured as a benefit." On the basis of computations explained in the Design Memorandum No. 2, Appendix C, Economics, it is estimated that over the economic life of the project, average annual benefits resulting from increased employment, in October 1977 prices, will amount to about $135,000 for the Burlington Dam and $62,000 for the Des Lacs River diversion tunnel.

4.85 A typical, if locally unforeseen, pattern of adverse institutional impact of project construction has been observed by Perle (1974), Hogg and Smith (1970), and by Gold (1974). The pattern presents the receiving area with an influx of workers and families who stimulate demand for expanded services. The local services structure is then adapted to meet this demand and a temporary "boom" is experienced in which local revenues show marked gains. After construction, when the workers have left and demand has returned to a lower level, the area finds itself faced with an under-utilized but costly service structure which the local residents must pay for through higher taxes. This potential adverse effect is noted here to underscore the point that prudent local restraint in response to temporary services demands will suffice to avoid such longer-term economic and structural consequences. The proportional size of the Minot area population and social service infrastructure relative to the expected construction labor force provides assurance against significant over-expansion.

4.86 The major positive economic impact of the project would be the reduction in property losses in Minot during flood events. There is also reduction in money spent in detouring around flooded areas, although it has not been determined whether this reduction would offset the possible increased transportation and equipment storage costs of

relocated farm and ranch residents who might retain the right to work present lands as a condition of granting easements. Equitable distribution of costs among persons and groups in proportion to benefits received (as stipulated by the Principles and Standards) is the point of issue on this question.

4.87 Several social benefits will result from a flood control project in the Souris River basin. The favorable social impacts will include a reduction in the disruption of regular family life, civic activities and community affairs due to major flooding. In addition to greater safety for those benefiting from the flood control project, flood control should also alleviate the sanitation problems associated with flooding. Flood control measures will prevent the types of unsightly conditions which prevailed in Minot and other flooded communities in 1969 and 1976, when receding floodwaters deposited mud and debris. In 1969, approximately 12,000 residents of the floodplain in Minot were evacuated to temporary quarters and many of their household furnishings and personal property were taken to dry locations for temporary storage. Minot experienced much difficulty in keeping its utility systems functioning. During the flood, faulty gas mains caused the explosion of two houses. Personnel and vehicles from the Minot Air Force base made an important contribution to the evacuation effort, but it cannot be assumed that in the future the same resources of manpower and equipment will be so readily available for diversion from military functions. In addition, there may not always be so much advanced warning as there was in 1969, particularly if the flood originates from the Des Lacs River or Gassman Coulee. The recommended plan will offer limited protection from these sources. The proposed project will lend partial protection from floods originating in the Des Lacs River (52 percent of standard project flood protection compared to 25 percent with the existing Minot channel), but lend no extra protection from floods originating on the Gassman Coulee.

4.88 The proposed project will have adverse social impacts on the portion of the reservoir area which is still in private ownership. Approximately 20 sets of buildings below elevation 1606, between Burlington and Baker Bridge must be acquired in fee title. Many of the economic hardships resulting from the relocations and land acquisitions required by the project will be mitigated through the entitlements of PL 91-646, the Uniform Property Acquisition and Relocation Assistance Act of 1970. Rural residents displaced by mandatory relocation might retain the right to continue ranching operations if a land acquisition policy of flowage easements were developed. However, special hardships resulting from the added permanent operating expenses addressed in section 2 may entail the imposition of excessive economic hardships not addressed by PL 91-646. If land acquired for project structures and mitigation were purchased in fee title, however, residents would not have the right to use these lands for ranching pursuits. Land purchased in fee title and later leased would not necessarily be returned to present owners for their

usage; leases would be purchased at public action, with first option reserved to other Federal agencies.

4.89 As discussed in paragraphs 1.30-1.32, there will be some probability for periodic summer inundation of 117 downstream residential properties and approximately 25,000 acres of agricultural land as a consequence of the operating plan for storage releases. Flowage easements will be sought on not more than 1,800 acres. The duration of such release-operation inundation depends on the timing and volume of a flood. In most instances, the duration would be less than under natural conditions. In rare instances, the duration of flooding may be extended as much as one week. These adverse social and economic impacts will be mitigated by a combination of preventive measures, including residential ring levees (15), raising residences (76), relocations (12) and flowage easements.

TABLE 23: CONTROLLED FLOODING EFFECTS OF 5,000 CFS RELEASE OPERATION PLAN

Amount of Residence Flooding	No.	Protective Measure
None	14	Access road only flooded*
0 to 2 feet	76	Residence raised 2 feet
3 feet	15	Levee around residence
4 or more feet	12	Residence relocated
	117	

* There is a total of 17.5 miles of access and town roads that are to be raised an average of 3 feet.

These will be provided largely at Federal expense with some local *local initiative in non-structural methods.* Local interests (the Ward and McHenry County Board of Commissioners and Water Management Boards and various citizen groups) have been informed in detail of the proposed plan of operation at several meetings. However, we cannot say at this time that every householder has been contacted, nor can we say who among them does or does not support the plan.

4.90 Social and psychological hardships would result from the proposed project. Lifelong residents would be required to move from homes and areas which have been occupied, in many instances, by several generations of ancestors. The attachments to lands and homes are especially strong in agricultural/rural areas. Additional, specifically inequitable, hardships would result from the mandatory evacuation of those individuals north of the recommended project site on the Souris River. These individuals would not benefit from the proposed flood control project, but would bear the major proportion of the adverse social impacts of the project, as these rural residents would be evacuated to protect urban area residents in the floodplain. A total of thirty households must be

relocated to accommodate structures, storage pool, and release operation for the selected plan. Precise and complete social and economic information has not been assembled on those persons and families to be displaced. In compliance with explicit and implied intent of Federal statutes, regulations, and guidance, Phase II study will present attribute, perception, and preference data about these persons in consideration of potential individual and systemic social effects of the project upon them. Data should include 1) familial ties to others in the area, 2) self-estimated interaction frequencies with significant others, 3) length of residence, 4) source of livelihood, 5) degree of apprehension about relocation, 6) expected place of relocation, 7) socio-economic status, and 8) age. Frameworks in social psychology, social organization, and aggregate behavior are available for the systematic assessment of impacts through such variables as those listed. (See T. Napier, 1972, 1974; Fitzimmons, Stuart, and Wolff, 1977; Wolff and Finsterbusch, 1974).

4.91 Inundation of public lands will also be an adverse social impact of the proposed plan. Public lands affected include the Upper Souris National Wildlife Refuge, Renville County Memorial Park, and Mouse River Park. These lands are used by area residents for such recreational activities as aesthetic enjoyment, park recreation, photography, bird and waterfowl hunting. The loss of 80 summer cottages as well as other recreational buildings in Renville County Memorial Park is also an adverse social impact of the recommended plan, particularly since the park has been used for years by area residents as a social gathering place. Owners of the 80 cottages would be given fair compensation for their properties in accordance with Public Law 91-646. However, adverse social impacts are not addressed by considerations of economic compensation. Specifically, adverse social impacts will accompany the mandatory relocation of these recreational properties. Decreased usage of Renville Park after removal of the 80 buildings is one potential social consequence. Therefore, an assessment needs to be made prior to the determination of whether flowage easements, in lieu of fee title acquisition of these parklands, would allow a level of usage comparable in type and quantity to the present.

4.92 The reservoir would be used only for the temporary impoundment of floodwater. Accordingly, flowage easements could be purchased on most private lands required, except for those lands needed for project structures and mitigation. Approximately 2,000 acres of agricultural land would be purchased and reclaimed for habitat mitigation. In accordance with flowage easement acquisition policy, all developments, including residences, lying within the flood pool must be relocated. Relocated residents engaged in ranching operations would retain the right to use the area, provided that those uses remain compatible with future project operation programs.

4.93 There would be some impacts in Manitoba due to higher sustained releases from Burlington Dam. These will be the subject of a study by the International Joint Commission, which will prepare recommendations to be subject to negotiations between the governments of the United States and Canada.

4.94 Levels of noise and air pollution are not expected to exceed usual limits produced in the temporary situation of heavy construction and will, for the most part, occur in locations remote from dense human populations.

CHANGES IN LAND USE

4.95 With the implementation of more permanent protection, as would be afforded by the proposed project, it is anticipated that an additional 1,000 acres of floodplain agricultural land would be developed for urban use between Burlington and Logan. Without the construction of the reservoir, it is probable that gradual evacuation of non-compatible development from the floodplain would occur, at a rate dependent upon the pattern of future flood events.

RECREATION IMPACTS

4.96 Lake Darling: Impacts on recreation at Lake Darling include the flooding of recreation areas adjacent to Lake Darling and the Souris River and alterations in the fishery. Permanent facilities at Mouse River Park (restrooms and cottages) would receive the greatest damage. Acquiring and removing damageable property would be necessary, possibly with later mitigation through development of more compatible recreation features at the site in cooperation with a local sponsor. Effects on other recreation areas would have a small impact. Flooding would require the temporary removal of picnic facilities and would require clean-up operations after flooding at the three boat landings on Lake Darling, Grano Crossing (bank fishing and picnicking), and Greene Crossing (bank fishing and picnicking).

4.97 Burlington Dam: Some recreation potentials would be made available by the Burlington Dam. Potentials exist for sightseeing, picnicking, hiking, fishing, and camping along the Souris River and within the lower section of the Upper Souris National Wildlife Refuge. Sightseeing, picnicking, and fishing are presently accommodated within the wildlife refuge. Along the Souris River, limited potential exists to develop camping, picnicking, and hiking facilities.

4.98 Impacts upon existing recreation due to periodic flooding include disruption of fish and wildlife habitat (affecting fishing and hunting) and inundation of fishing and picnicking areas at Baker Bridge and St. Mary's Bridge. Impacts are projected to require clean-up operations at picnic areas.

4.99 Constraints upon future development due to flooding require that permanent facilities (restrooms and picnic shelters) be located above flood elevation. Picnic areas, hiking trails, camp pads and boat access areas could be put in inundation areas but would sustain some damage. Any fishing access and parking provided later by the Corps may mitigate for flooded fishing areas. It is unlikely fishing quality at these areas would equal fishing at Baker Bridge.

CULTURAL RESOURCES IMPACTS

4.100 The project impacts on cultural resources cannot be accurately assessed until field surveys and intensive testing are completed. The numerous site leads obtained from local informants and from historic accounts suggest that a large number of prehistoric, historic, and architectural remains will be located within the various project areas. The intensive surveys will be conducted to determine the presence of cultural remains, and to evaluate their existing condition and significance. All sites located within the project impact areas that are determined to be eligible for inclusion on the National Register of Historic Places will be avoided, if possible, or else the adverse impacts will be mitigated by qualified personnel, following consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation. In addition, the construction contractors will be instructed to immediately discontinue work and notify the St. Paul District Archaeologist should previously undetected cultural resources be encountered during construction. The following paragraphs identify the currently known and potential resources in the various project areas. (Also see paragraphs 2.173-2.195.) The preliminary results from the ongoing survey have not been incorporated, so few changes have been made since the draft environmental impact statement.

4.101 North of Minot to Lake Darling and the Des Lacs Diversion Tunnel and Dam: The reconnaissance survey located six prehistoric sites within the Burlington pool area that would be adversely affected by the project. The significance of these sites will be evaluated, and those that are determined to be eligible for inclusion on the National Register will have the adverse impacts mitigated. The other four sites located by the reconnaissance are located on the bluffs at higher elevations than the proposed 1620-foot pool area.

4.102 The record and literature review identified over 150 site leads for this general area. ("General area" means the sites were reported to be located within the same township as the project area.) These include a large number of prehistoric sites, a reported Assiniboine Indian village, possibly near Minot, and a number of early industrial coal mines and brickyards near Burlington. Presently available information on these site leads is minimal. Because the information was recorded a number of years ago, the site location and site description are often faulty. In addition, many of these sites have probably been disturbed or destroyed in the intervening years.

4.103 The review of paleontological resources identified several areas south of Burlington and approximately 30 miles northwest of the Des Lacs diversion tunnel where fossils from Tongue River strata have been reported. According to the study, there are no known paleontological resources within the project areas; however, the construction of the dam and diversion tunnel may uncover fossil-bearing strata. A qualified paleontologist will be immediately notifed if this occurs.

4.104 Lake Darling Dam to the Canadian Border: The record and literature review identified approximately 100 site leads in this general area, including a number of prehistoric sites, Indian trails, a site containing military artifacts, and numerous early townsites, stagecoach stops and post offices. The intensive survey will identify the prehistoric, historic, and architectural resources located within the project areas.

4.105 Levees at Sawyer and Velva: The record and literature review identified approximately 25 site leads in this general area. The project impact areas will be surveyed for prehistoric and historic resources. Extremely valuable fossils from the Cannonball formation have been reported in the area of Sawyer. These relatively rare marine fossils date from the Paleocene period when great inland seas penetrated the continental interior. All younger deposits are non-marine. Further investigations will be necessary when the project plans are finalized to assure that no fossil deposits are destroyed.

4.106 J. Clark Salyer National Wildlife Refuge: The record and literature review identified approximately 25 site leads in this general area. Additional investigations will be carried out as needed as project plans are finalized and specific impact areas are determined.

MITIGATION OF ENVIRONMENTAL DAMAGES

4.107 In July 1975, the St. Paul District, Corps of Engineers entered into an agreement with the USFWS to quantify habitat losses that would occur if Burlington Dam were constructed. It was agreed the quantification would be made using a system developed by the USFWS that identifed wildlife habitat in habitat units (HU's). The evaluation system is entitled Habitat Evaluation Procedures (HEP).[1] HU's are a product of the value of a given habitat type for a group of representative species expressed in habitat unit value per acre and the number of acres of that habitat type in the project area.

4.108 Field evaluations of habitat types present in the project area were conducted in the fall of 1975 by members of the Corps of Engineers and the USFWS. In September 1976 the USFWS supplied the Corps with a report that ranked several dam alternatives and operating plans that were under consideration according to wildlife habitat losses that could be expected. These losses, expressed in HU's, were the difference between "with" and "without" project conditions. This preliminary HU analysis indicated that the maximum release plan (5,000 cfs) was the least damaging for all alternatives and that in order of least to most damaging to wildlife habitat, the large dam alternatives were: the Lake Darling raise in combination with Burlington Dam (Corps recommended plan), Burlington Dam alone and Lake Darling raised to allow control to elevation 1620. Other factors (e.g., impacts to managed marsh units) led USFWS to list Lake Darling Dam raised to 1620 as the best overall among these three plans, however.

4.109 A subsequent HU analysis was made in January 1977 by the Corps for the purpose of providing a generalized estimate of project-induced terrestrial HU losses and acreage of reclaimed wetlands necessary to mitigate the losses. This evaluation was very abbreviated and involved the following assumptions:

a. Only impacts resulting from increased flood inundation were considered within the floodpool and downstream.

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[1]See Exhibit 1 for a description of the HEP methodology.

b. Flood events less freqent than those with a 4-percent chance of occurrence from the Upper Souris in any one year were the only ones considered.

c. Only balanced, synthetic hydrographs for the 25-, 50-, 100-, and 200-year floods on the Souris River were evaluated.

d. No evaluation was made of impacts resulting from floods, flood storage, or the diversion works from the Des Lacs River.

e. Downstream evaluation was limited to changes in stage-duration within the 5,000 cfs outline.

f. No evaluation of induced land use changes or habitat changes due to a reduction in flood nourishment was attempted.

g. Local protection features were not evaluated.

h. Aquatic impacts were not evaluated.

i. Impacts on marsh vegetation due to carp introduction were not evaluated.

j. Mitigation with reclaimed wetlands with a management potential of 70 HU/acre was assumed (maximum HU/acre possible is 100).

k. Maximum benefits from reclaimed wetlands occur the first year the project is operational.

l. Maximum drawdown of Lake Darling prior to floods to elevation 1594 with release of inflow up to 5,000 cfs at Minot until 15 May.

m. No evaluation was made of the impacts of road, railroad, utility, cemetery or real estate relocations.

n. Impacts of weed control were not evaluated.

4.110 Based on these limiting assumptions, it was estimated that from 1,200 to 2,000 acres of reclaimed wetlands would be necessary to mitigate the terrestrial habitat losses (measured in HU's) that would occur due to the recommended project. Subsequent to the Corps' January 1977 analysis, a meeting was held between representatives of the St. Paul District and Region 6 of the USFWS. The outcome of this meeting was an administrative agreement between the two agencies to limit mitigation acreage for the recommended plan to 2,000 acres. In addition, the 4-foot raise of Lake Darling Dam and modifications to the low-head refuge dams were agreed upon as necessary to insure continued operation of the dams for their original primary purpose, the propagation and enhancement of waterfowl.

4.111 Since the January 1977 agreement, the operating plan has been modified to include storage behind Lake Darling for floods more frequent than once in 25 years, the period of time of maximum release

has been shortened, 1,000 acres of land use changes have been identified downstream, and 1,000 acres of tree plantings have been requested by the Nortn Dakota Game and Fish Department.

4.112 In a 25 April 1977 planning aid letter submitted under the F&W Coordination Act (Public Law 85-624), the USFWS concluded that terrestrial mitigation requests of 2,000 acres of reclaimed wetlands, 1,000 acres of tree plantings, and structural modifications to refuge dams would represent 65-percent compensation of project-induced terrestrial HU losses. This estimate did not include effects of the proposed operating plan for control of frequent Souris River floods, construction and operation effects of the Des Lacs diversion, construction of local protection features, aquatic impacts, effects of carp introduction on both aquatic and semi-aquatic communities, and management (and costs) of project lands for wildlife. In addition, the FWS included, to an undertermined extent, the effects of downstream clearing and snagging which has since been deleted from the recommended project.

4.113 The USFWS indicated in their 25 April 1977 report that mitigation for aquatic habitat losses may be requested at some future date following additional study. Further, they indicated that additional mitigation studies for project features not yet evaluated should be conducted. Finally, any lessening of the reservoir release rates would represent a major additional adverse impact that would require them to greatly expand the mitigation plan or oppose the project. Based on the USFWS mitigation plan compensating for only 65 percent of project induced habitat damages at an initial cost of $1,613,000 (excluding carp control), unmitigated residual habitat damages are estimated at $1,432,000 (ER 1105-2-129, paragraph 11 b and c) assuming similar acquisition and development costs.

4.114 In an 8 September 1977 letter, the USFWS basically reiterated their support for the agreed-upon mitigation plan of 2,000 acres of reclaimed wetlands, 1,000 acres of tree plantings on project lands, a 4-foot raise of Lake Darling Dam, and modifications to the low-head refuge dams. (It has not yet been determined just where the 1,000 acres of tree plantings would be. At the time the proposal was developed, fee title acquisition was planned to the limit of the design flood pool, and the plantings would mainly have been on project lands upstream of the Upper Souris refuge. Under the present real estate plan with more restricted acquisition, the plantings would be more restricted to uneconomic remnants below Lake Darling. Although there are climatic and site limitations on tree plantings in the area, the assumption at this time is that 1,000 acres of suitable sites can be found.) Further, USFWS concurred in proposals for more detailed study of carp control and aquatic mitigation needs, and the ultimate inclusion of features in the project to mitigate these problems. Thus, they reasoned, there no longer are any unresolved major issues from the standpoint of the USFWS.

4.115 The USFWS letters are reproduced in the technical appendix of the final EIS.

AESTHETIC IMPACTS

4.116 The evaluation of aesthetics, in the context of impact assessment, is a matter of professional judgement based upon formal training in an appropriate discipline. Within the present impact statement, the adopted definition of aesthetic degradation is "a change from the natural appearance of a river and its riparian lands, or what one might refer to as existing conditions."

4.117 In considering aesthetic impacts, the major item of concern would be those areas located upstream from the proposed Burlington Dam. The impacts of flooding on vegetation (see also paragraphs 4.43 to 4.72) will bring about successional changes which by most people's standards are undesirable. These changes, along with flood-deposited debris and increased erosion, will modify the Souris River valley (upstream of the Burlington Dam) in such a manner that it will be less attractive to the onlooker and will provide a reduced recreational experience.

4.118 In a State where forested land is not particularly abundant, the projected losses of bottomland hardwoods is significant. Although the loss of the natural beauty of these areas is not measurable on an economic scale which calculates the benefits and costs of protecting development in the floodplain, these losses must nevertheless be acknowledged. These same aesthetic amenities contribute to what is so often referred to as our "quality of life." This is a loss that will not only affect present populations but also future generations.

4.119 The other features of the project, such as the Des Lacs diversion tunnel, and levee upgrading between Burlington and Minot and at Sawyer and Velva, would have lesser aesthetic impacts due to their urban locations or previously disturbed condition.

5.00 UNAVOIDABLE ADVERSE IMPACTS OF THE PROPOSED PLAN

5.01 The total area of cultural features, bottomland hardwoods, agricultural lands, and marsh affected by project structures would not recover to natural biological systems via ecological succession because the structures would be maintained as necessary to preserve their flood control utility. The areas that would be significantly affected would mostly be the reach between the dam site and Lake Darling Dam and the area above Lake Darling Dam.

5.02 Unavoidable adverse social impacts would result from the required relocation of about 25 rural residences and ranch operations in the reservoir area. This would also result in increased expense and inconvenience to local agricultural interests, should the relocation increase travel distances between ranch lands and bases of operation. Some public lands - the Upper Souris NWR, Renville County Park, and the Mouse River Park - would be inundated and reduced in value for recreational activity. In addition, 80 privately owned summer cottages at Renville County Park would be acquired under the proposed plan.

5.03 During years which required significant storage of floodwaters in the recommended Burlington Reservoir, habitat damage would be severe. The affected wildlife, including deer, muskrat, mink, rabbit, and pheasand, would suffer population losses proportional to the amount of flood damage to their habitats.

5.04 Three-hundred acres of bottomland hardwoods located within the design pool above Lake Darling Dam would be seriously damaged or destroyed due to storage of a 1-percent chance flood. Of 1,400 acres of bottomland hardwoods located within the design flood pool of the proposed reservoir, 450 acres would be destroyed by an inundation of over 5 months. Stream production would also be harmed by damage to the trees.

5.05 Fifteen-hundred acres of wetlands above Lake Darling Dam are subject to increased flood storage. Floods requiring storage behind Burlington Dam would inundate 2,100 acres of marsh between Burlington and Lake Darling Dams for an entire growing season. Damage to the wetlands would be considerable. Although recovery could take place over a few years, there could be long-term effects such as shifts in species composition.

5.06 Approximately 2,000 acres of grassland between Burlington and Lake Darling, and another 350 acres in the Des Lacs valley would be affected by the proposed project. Floodwater storage of even a few days can kill grassland sod and cause weedy species to flourish. Severely damaged grasslands may never recover completely from a major flood event.

5.07 The impacts of the proposed levee and channel works would involve removing trees along 3,000 feet of channel, removing 5 acres of trees in channel cutoff areas, removal of trees along channel banks to facilitate machinery movement, and increased erosion and stream turbidity.

5.08 The benthic communities in the areas of the proposed project would be adversely affected by the increased sediment levels and the physical disruption to their environment caused by project construction. As a result, aquatic production would be decreased for several years.

5.09 The impacts to the area above Lake Darling depend upon operating procedures utilized by the USFWS. Because of plans to hold water at elevation 1598 until fish spawning has been completed, the area between 1596 and 1598 would suffer from reduced stream productivity, destruction of streamside vegetation and an associated reduction of terrestrial organic food material, increased sedimentation and decreased bank stability. At Lake Darling, flood events greater than a 2-percent chance flood would have a detrimental effect on northern pike spawning, since much of the presently suitable area above 1598 would become unsuitable. Holding Lake Darling at elevation 1598 for prolonged periods of time, coupled with inundation to higher elevations would increase erosion around, and sedimentation in, the reservoir, exacerbating the already eutrophic conditions. This could decrease the value of the existing game fishery, hastening its succession to a panfish/bullhead fishery. During years requiring storage behind Burlington Dam, the aquatic community between the dam and Lake Darling would be subject to increased siltation, reduction of spawning opportunities for northern pike and walleyes, and reduction in number and diversity of invertebrates.

6.00 ALTERNATIVES TO THE PROPOSED ACTION

6.01 Burlington Dam was authorized under the Flood Control Act of 31 December 1970 (Public Law 91-611). Phase I planning efforts, which are the basis for discussion in this document, are intended as an objective reassessment of the authorized project to either reaffirm the project as authorized or to modify it as required to meet changed conditions. As such, major study efforts were directed toward alternatives involving a large dam at or near the authorized site, since survey studies (preauthorization) had revealed that a large storage reservoir on the Souris River was the only alternative that was economically feasible, provided Minot with a high degree of protection from the Souris River, and was acceptable to a majority of Minot residents. Alternatives for flood damage reduction at Minot and other river reaches in addition to large dams on the Souris River are also presented and are discussed below. This will allow the reader to identify the environmental/econonomic/social tradeoffs that were made in arriving at the recommended plan and to evaluate its responsiveness to meeting the broad-based water and related land resource needs of the Souris River basin in an equitable manner.

6.02 To shorten the length of time between reformulation planning efforts and construction of a dam on the Souris River, certain Phase II studies (advanced engineering and design) were conducted concurrently with the present plan reformulation effort. To date, approximately 40 percent of these studies have been completed. These advanced design studies have been directed at the following features of the recommended plan: formulation designs for the Burlington Dam and appurtenances and the Des Lacs diversion; soil borings for Lake Darling Dam; detailed design for interior drainage facilities at local protection areas; channel capacity studies from Minot to Bantry; and formulation designs for road and railroad relocations/raises. Although certain of these results would be applicable toward the design of alternative projects, they have been directed mainly at the recommended plan. The Phase II studies that have been conducted concurrently with Phase I are those with a high likelihood of being in the finally selected plan. Initiation of Phase II studies prior to approval of the Phase I report assumes that the recommended project would not require reauthorization by Congress or, that if required, Congressional authorization would occur.

6.03 The basic criteria used in reaffirming or reformulating the Burlington Dam alternative(s) were as follows:

a. The maximum practical degree of flood protection should be provided to Minot and other susceptible areas.

b. The plan must be economically feasible with an excess of benefits over costs.

c. Local project costs (cost sharing) must be within the financial capabilities of local sponsors.

d. The plan should not cause water to be backed up into Saskatchewan and should attempt to minimize any adverse changes to the flow regime in Manitoba.

e. Adverse impacts should be balanced between the downstream ranchers and the upstream interests (ranchers and the Upper Souris NWR).

f. Adverse impacts to the J. Clark Salyer NWR should be minimized to the extent practicable.

g. Minot should be provided with a high degree of flood protection in the shortest possible time.

Alternatives are discussed under the general classification of nonstructural and structural to facilitate review by the reader. A table comparing the various alternatives considered can be found at the end of Section 6 (see table 24).

NONSTRUCTURAL

Alternative 1 - No Action

6.04 The no action alternative is in reality a viable alternative but represents no action on the part of the Corps of Engineers. Certain conditions are expected to occur in the future if none of the flood control measures that are discussed in this section are implemented. The no action alternative future is conceived to include floodplain regulations, flood insurance, channel modifications at Minot, flood warning and emergency measures, and rehabilitation of Lake Darling Dam to meet current engineering standards for such a structure.

6.05 The Minot channel modification, which involves increasing the capacity of the existing channel from 1,500 to 5,000 cfs, is about 95 percent complete. It should be noted that the Minot channel was originally conceived to be an integral part of any flood control plan for Minot. Because of the need for some type of early structural solution to the flooding problems at Minot, the Minot channel was authorized separately until Burlington Dam could be constructed. Through the construction of the 5,000-cfs channel, the economic feasibility of all other alternatives was reduced because the channel can control floods up to those expected once every 25 years. It is these frequent flood events which result in the greatest average annual damages and, conversely, provide the greatest average annual benefits when controlled. Although the 5,000-cfs channel does not provide an acceptable degree of protection for an urban area, it must be considered in determining the base condition. The effect, then, is that any second-in-place project loses a large portion of its benefits to the existing first-in-place channel, which significantly reduces its benefit/cost ratio. It is the benefit/cost ratio, more than any other factor, that commonly determines or influences

the selection and sizing of a particular project. Therefore, the 5,000-cfs Minot channel has reduced the number of options available.

6.06 Floodplain Regulation and Insurance. The communities of Burlington, Minot and Velva are currently participating in the national flood insurance program administered by the Federal Insurance Administration, which requires federally approved floodplain regulations as a prerequisite for any Federal participation (grants, insured loans, etc.) for improvements within the 100-year floodplain. Ward County has also passed the required legislation to insure that the unincorporated areas of the county can qualify for flood insurance. The community of Sawyer, although supplied with the required information outlining flood hazard areas, has indicated that it would not participate in the program, probably because of the sparse and low-cost developments within the floodplain in that community.

6.07 The national flood insurance program was created to curb the continually increasing annual losses from flood damage and was intended to be an alternative to structural programs and a method of reducing direct Federal disaster relief. Although it does not prevent flood damages from occurring in the short term, flood insurance would assist property owners in recovering from flood damages. In the long term, floodplain regulations and flood insurance reduce nonconforming uses and promote evacuation in some cases.

6.08 Strict floodplain regulations do have some adverse impacts. Floodplain zoning regulations restrict alterations and extensive repairs to existing non-conforming uses within the regulatory floodway. Normal maintenance and repairs are permitted for all existing floodplain structures. Existing structures in the flood fringe can also be extensively repaired or altered. The only structures that are required to be protected to the 100-year flood level are those newly constructed or substantially reconstructed after the date that base flood conditions were supplied to the community.

6.09 Those structures built prior to the date that the base flood elevations were provided may receive federally subsidized flood insurance without being protected to the 100-year flood elevation. New structures built after the determination of base flood elevations are eligible only for actual flood insurance rates, i.e., the risk of flooding relative to the elevation of the structure.

6.10 The economic and social impacts of floodplain regulations for residents of the 100-year floodplain would be great since it would internalize the costs of floodplain development more than any other plan. Correspondingly, the public not residing in the floodplain would experience the smallest adverse social and economic impacts with this plan. The impacts for the larger public would be due to the nature of the program which, for example, does not allow Federal disaster relief for insured properties. This would reduce Federal costs to Federal subsidy of insurance payments until the existing structures in the floodplain become obsolete and are replaced, at which time Federal participation would theoretically end. Therefore, this plan would be very acceptable to the nonresident public.

6.11 Flood Proofing: Another aspect of floodplain regulation is to flood proof structures in the floodplain. This involves such measures as elevating structures and access roads and streets to clear predicted flood levels; eliminating or deliberately flooding basements; providing measures for seepage control; providing bulkheads on doorway and window openings; putting check valves on sewer lines; underpinning structures; and providing other measures to prevent damages to the structures. Because of the flat gradient of the Souris River and the large area that it drains, flood flows rise and fall slowly. Overbank flooding at Minot can prevail several weeks at depths of 8 feet or more. Valley floodplain soils are mostly clay and become highly saturated and expansive during floods. The saturated soils tend to cause differential settling around the foundations of flood proofed structures, resulting in serious structural damage or even ultimate collapse of the structure. Unless flooded or reinforced, basement walls are subject to collapse from water pressure exerted against the wall.

6.12 Permanent flood proofing is not practicable for some of the existing floodplain structures due to their age (many of them are 50 to 75 years old). For other structures, raising the building would be required. If access during floods were required, streets would also have to be raised. However, flood proofing coupled with evacuation would reduce the need for this requirement.

6.13 Temporary flood proofing techniques such as placement of bulkheads on doorways and windows, although partially effective for floods originating on the Souris River, would be less effective for Des Lacs River and Gassman Coulee floods because of the possibly insufficient time available to implement these measures.

6.14 Nevertheless, flood proofing techniques, particularly the raising of existing buildings and flood proofing new structures outside of the floodway (revision necessary for Minot), should be encouraged with any plan for flood damage reduction.

6.15 Flood Warning and Forecasting Services and Emergency Protection: Flood warning/forecasting and emergency protection have been in effect in the area since the 1969 flood and would continue to occur under the no-action alternative and with the proposed plan.

6.16 Since most of the Souris River basin above Minot lies in Saskatchewan, data required for flood warning and predictions involve coordination with Canadian officials. The National Weather Service in Bismarck has been informally designated as the agency to handle the transfer of basic hydrologic data between the United States and Canada. Coordinated snow surveys in both the United States and Canada are routinely made on 15 March in normal years. Should there be an excessive amount of snow

accumulation early in the winter, [illegible] 15 February and updated as warranted by [illegible] hydrological developments. In addition, [illegible] Control meets each spring to determine the [illegible] Lake Darling Dam, which in the past has [illegible] least 50,000 acre-feet [illegible] storage [illegible] above-normal runoff is [illegible].

6.17 Long range flood [illegible] systems for the United States portion of the [illegible] were developed by the National Weather [illegible] flood. By 1974, forecasting procedures [illegible] Souris River basin. These [illegible] reporting networks in the United [illegible] phone telemetry gaging [illegible] the water content of the snow. [illegible] telemetry [illegible] ment has been installed on the Des Lacs River at Foxholm; [illegible] River at Foxholm, Minot, and Westhope; and the Deep [illegible]. Radio telemetry equipment has been installed on [illegible] Noonan and Western Crossing. The Corps has been informed [illegible] National Weather Service will investigate the [illegible] program [illegible] metry permits the [illegible] reduces the risk of loss [illegible] occur in areas like the Gassman Coulee [illegible]. Improved warning systems would also permit earlier construction [illegible] emergency levees where flash flood situations are involved. [illegible] especially significant since Gassman Coulee would not be [illegible] the proposed project.

6.18 Even though emergency protection was successful in passing [illegible] 9,350 cfs through Minot in 1976 with only minor damage, total [illegible] on improved warning systems and emergency works would be ill[illegible] because of the uncertainty involved in containing large floods [illegible] needed for emergency measures for protection from the [illegible] and Gassman Coulee and the continued disruption of the urban [illegible].

6.19 It should be noted that the Souris River represents the [illegible] risk for economic loss because of its large and frequent [illegible]. Severity of floods is greatest for Gassman Coulee, followed by [illegible] Lacs River, owing to their much steeper gradients and rapid [illegible] characteristics. Less risk would be involved at Sawyer and Velva because of their limited size, lesser development along the riverbanks, and the good levee base existing in both communities. However, even at these communities the risks are great enough to preclude reliance [illegible] emergency measures as an effective flood damage reduction alternative.

6.20 Finally, the no action alternative or "future without the project" condition includes the rehabilitation of Lake Darling Dam to current engineering standards. It is recognized that Lake Darling Dam is currently unsafe. A flood on the Upper Souris River of a magnitude that would overtop the structure (about a 200-year flood) could result in serious erosion of the downstream dam face and could result in the dam being breached in an extreme case. Such an event would result in catastrophic damages in Minot and other downstream areas.

6.21 In light of the current Federal dam safety program, it is assumed that the future condition in the area would include upgrading Lake Darling Dam to standards necessary to insure its integrity under extreme flood events.

6.22 In addition to being part of the no action alternative, the rehabilitation of Lake Darling is assumed for all alternatives with the exception of those involving large dams on the Souris River, i.e., numbers 6 through 14. The rehabilitation in these cases would be preempted by an alternative future condition.

Alternative 2 - Floodplain Evacuation

6.23 This alternative involves the removal of all developments in the 100-year Souris River floodplain between Burlington and the J. Clark Salyer Refuge.[1] The estimated total cost of the evacuation alternative is $265.95 million. Non-Federal costs would amount to about $44.45 million. Comparing average annual benefits of about $8.83 million to average annual flood control costs (difference between total costs and social betterment costs) of $13.75 million yields an uneconomic benefit-cost ratio of about 0.64.

6.24 The massive relocations that would be required make implementation of the evacuation plan very questionable. About one-third of the residences, all of the schools and churches, and nearly all of the businesses in the floodplain would have to be replaced, as either age, physical size, or construction materials would make moving the existing structures infeasible. Much of the old building material would be worth little as salvage; thus a massive cleanup program would be required to rid the floodplain of demolished buildings. The proposal, which would take from 8 to 10 years to complete, would require construction of new utilities, streets, and service roads at the relocation sites; revising existing utility lines within and along the fringe of the floodplain; and raising several major thoroughfares crossing the floodplain to permit uninterrupted cross-valley traffic during large floods. Approximately 13,800 residents of the 100-year floodplain (about 12,000 in Minot) would be required to relocate. Disruption of long-standing neighborhood and cultural ties and the physical division of the city of Minot into northern and southern sectors could lead to adverse social and institutional problems.

6.25 The estimated social betterment costs principally include the increased costs of providing improved or new residential and business buildings that would meet current codes and standards. However, social betterments may be partially offset by the increased taxes and rents that dislocated property owners would be forced to bear. Since the non-Federal costs greatly exceed the fiscal capability of the local

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1 It is possible that some structures could be flood proofed economically or are already flood proofed which would reduce the scope and costs of this alternative by an undetermined amount.

governmental units involved, financial assistance to implement the evacuation alternative would have to come from the State or be provided by the Federal Government. The significant advantages of the evacuation alternative are that flood damages would be nearly eliminated without disturbing the existing river system, and evacuated areas could be returned to a more natural environment, leading to a increase in environmental values in the floodplain. Also, the vacated floodplain, zoned and managed as "green space," could provide recreation benefits for area residents.

6.26 As noted in paragraph 6.23, the local costs for this alternative are estimated at $44.45 million. This would place a substantial burden upon Minot and has serious implications with regard to the implementability of the alternative. Although the costs would be great, they are viewed as equitable since those individuals receiving project benefits would be required to make a significant portion of the sacrifices in the form of monetary support and relocation (see dicussion of this topic under the Environmental Quality Plan, paragraphs 6.90 to 6.92).

STRUCTURAL

Alternative 3 - Boundary Diversion

6.27 The alternative of diverting Souris River flood waters immediately upon entering the United States was given early consideration. The diversion channel would have a top width of about 516 feet and an average bottom width of 60 feet. The channel would parallel the Canadian border for a distance of about 45 miles. The excavated channel would require about 2,800 acres. Disposal of the excavated material would require a strip 1,200 feet wide along the entire channel length on one side, and area of 6,500 acres. The material would be distributed to a depth of 10 feet.

6.28 The channel would be designed to pass up to 14,000 cfs, providing Minot with 100-year protection from floods originating on the upper Souris River. The forebay at the channel inlet would cause backwater effects and flooding in Saskatchewan. Diversion flows would outlet into J. Clark Salyer NWR and would increase peak flows in the lower end of the refuge and in Manitoba. The channel would affect normal surface and groundwater flow-patterns. Disposal of excavated material and the channel itself would require several thousand acres of agricultural and prairie lands and would affect many roads and farm operations. Because of its environmental, social, and economic (B/C = 0.34) disadvantages, the boundary diversion alternative was not given further consideration.

Alternative 4 - Flood Barriers

6.29 This alternative would involve upgrading existing emergency levees to current engineering standards for permanent levees in urban flood areas along the Souris River. These include the nine subdivision areas between Burlington and Minot, and the cities of Minot, Logan, Sawyer, and Velva. Protection against a 100-year Souris River flood was considered, which corresponds to a discharge of 14,000 cfs in the Burlington to Minot reach and the Minot reach and 17,000 cfs at Sawyer and Velva.

6.30 In the Burlington to Minot reach this alternative would involve upgrading approximately 5.9 miles of seven intermittent levee systems protecting 9 subdivision areas that are all residential; realignment, raising, and flattening slopes; recompaction and extension of the levees; and installing permanent interior drainage works including five pumping stations, ponding areas, and interceptor storm sewers and ditches. In areas where the levee is confined between the rivers and adjacent residences the river channel would be realigned and riprapped to prevent erosion.

6.31 At Minot, this alternative would involve reconstruction of about 13 miles of emergency levees flanking both banks of the river through the city (including 3,500 lineal feet of floodwall). Levee heights would range from about 3 to 10 feet. Major features would include riprapping nearly the entire length of the channel, construction of 12 new bridges and approaches, and relocation of approximately 275 homes. Real estate requirements would include the acquisition of 150 acres of land. Interior drainage facilities would include eight pumping stations, ponding areas consisting of mostly abandoned river loops severed by channel cutoffs, collector sewers, and ditches. In addition, the levee plan would require extensive alterations to existing utility lines including storm and sanitary sewers and water mains.

6.32 The work at Sawyer and Velva would be similar to that involved in the Burlington to Minot reach. Approximately 0.8 mile of levees protecting residential development at Sawyer would be upgraded to pass a flow of 17,000 cfs. Interior drainage works would consist of collector ditches leading to a ponding area (no pumping stations would be required). Riprapping would be required to protect the channel banks from erosion.

6.33 At Velva, approximately 1.9 miles of levee would be upgraded to pass a flow of 17,000 cfs. In addition, this alternative would involve the construction of a channel cutoff, replacement of a bridge, and channel riprapping. Interior drainage works would involve two pumping stations, two ponding areas, and collector storm sewers and ditches. The river loop abandoned at high flows by the channel cutoff would serve as one of the ponding areas at Velva.

6.34 Like alternatives 2 and 3, alternative 4 is also based on the assumption that the Lake Darling Dam would be upgraded to meet current engineering standards and that the dam would be operated for flood control as in the past.

6.35 The total cost of alternative 4 is $68,330,000. Non-Federal costs total $29,794,000, including $28,000,000 at Minot. Alternative 4 would provide a high degree of protection from the Des Lacs River and Gassman Coulee and would reduce overall damages by 76 percent. This alternative has a benefit-cost ratio of 1.41 and would be economically feasible. However, this alternative would pose a hazard to life in view of the relatively low degree of protection from the Souris River, and the length of levee involved would increase downstream flood stages. In addition, this alternative would not be implementable due to the high local cost.

Alternative 5 - Minot Tunnel Diversion

6.36 This alternative consists of: (1) upgrading emergency levees at several residential areas between Minot and Burlington so that Souris River flows of 14,000 cfs could be passed with no flood damage; (2) a 2.2-mile diversion tunnel beneath Minot with a capacity of 9,000 cfs and 25 miles of river channel modifications downstream of the tunnel; and (3) levees and channel modifications at Sawyer and Velva to provide a 100-year level of protection. The combined level of protection at Minot with this alternative would be about 110 years. The level of protection from the Des Lacs River and Gassman Coulee as single sources would be much greater, however, up to about a 0.01-percent chance flood) in both cases. The lower level of protection from all sources occurs because the tunnel provides only 100-year protection from the Souris River.

6.37 This alternative is economically infeasible by a small margin, with the benefit-to-cost ratio equal to about 0.99.

6.38 The major adverse impacts attributed to this alternative are associated with the disposal of excavated material, downstream channel modifications, a ponding area upstream of Minot, and local cost sharing requirements.

6.39 To pass 9,000 cfs, the diversion tunnel would need to be at least 31 feet in diameter. The amount of excavation required would create a large disposal problem. Depending on the soil properties of the excavated material, disposal would be accomplished in an as yet undetermined landfill and/or on agricultural land or grasslands where the material could be spread or worked into the existing soil. In the latter case, easements or fee titles would be required for disposal sites until the land again became arable. Agricultural and/or wildlife production would be lost until a time when revegetation of disposal areas was effected. If the land were to be seeded and set aside for revegetation for a period of years, it would generally be better wildlife habitat during that time than if it were still in agricultural use.

6.40 Downstream from the tunnel exit for a distance of about 25 miles, the existing river channel would need to be enlarged to prevent backwater effects in Minot. Refinement of the engineering aspects could reduce the length or size of the channel to an undetermined extent. The excavated channel would have a bottom width of 105 feet and would require increasing the top width an average of 70 feet. Lands lost due to excavation would be about 212 acres. Additional lands would be impacted for side channel disposal of the excavated material.

6.41 Riparian communities along the excavated channel would suffer irreversible losses. On disposal sites, existing vegetation would be replaced by early stage successional types which would have reduced habitat value for existing wildlife species. The quality of disposal sites would depend largely upon the replanting scheme and subsequent land use, however.

6.42 Aquatic communities in this reach of river would recover to some extent. The period of recovery could be quite rapid if repopulation from upstream sources occurred. However, recovery would probably not be complete since the river would meander within the modified channel during low flow periods, causing a shifting bottom type which would not be conducive to high populations of aquatic organisms. Also, stream temperatures, especially during low flow periods, would experience wider fluctuations than under existing conditions due to the reductions in overbank shade and average water depth.

6.43 It should be noted, however, that the aquatic communities presently inhabiting this reach of the Souris River are characteristic of polluted conditions (Ulrich and Pfeifer, 1976). This has resulted from widely fluctuating natural flow conditions (zero flow during some periods), discharge of organic material from the wastewater treatment facilities at Minot, and construction activities associated with the Minot channel project.

6.44 Upstream from Minot, the construction of the diversion structure would result in minor impacts, and operation could result in vegetational changes in an area upstream of the structure. These impacts would be expected to be relatively minor, however, due to the urban nature of the area.

6.45 Impacts at local protection areas would also be expected to be minor and short-term since emergency levees already exist at these sites and permanent levees would not require much additional land.

6.46 Downstream from Velva (farthest downstream local protection area) the project impacts would be minimal since little, if any, difference in flooding would be experienced. In fact, a reduction in the flooding regime in these areas could result in certain economic and environmental damages. The production of natural hay and wildlife associated with the riparian communities and temporary wetland complexes in these areas are dependent to some extent upon natural spring flooding for their productivity. By reducing spring floods, a certain amount of agricultural and wildlife production would be lost.

6.47 One last adverse impact associated with this alternative relates to the local cost sharing requirements for Minot and the local protection areas. Since the diversion tunnel would clearly be a local protection project, the local sponsors would be required to supply cost sharing for certain project features. For Minot, this would amount to about $10 million. Since this would represent a hardship for the city, the alternative does not have the support of local sponsors and is therefore institutionally unacceptable.

6.48 Because other flood control alternatives are available that provide Minot with a higher degree of protection and require fewer local monetary commitments by the city, this alternative was not recommended for construction.

Alternative 6 - Burlington Dam

6.49 This alternative is identical to the recommended plan discussed in sections 1 and 4 of this document except that the Des Lacs diversion tunnel has been deleted. With the above feature deleted, the benefit/cost ratio is 1.62 and the combined degree of protection at Minot from all sources is about 130-year. Protection from Des Lacs River floods to a 250-year level is provided by the existing 5,000-cfs Minot channel.

6.50 Impacts resulting from this alternative are the same as those of the recommended plan, except for those resulting from construction and operation of the Des Lacs diversion tunnel.

Alternative 7 - Lake Darling Dam

6.51 This alternative is essentially a modification of alternative 6 (i.e., the recommended plan without the Des Lacs diversion tunnel) in that the large reservoir storage structure would simply be located upstream at the site of the existing Lake Darling Dam. At this location, the amount of flood control storage would be 383,000 acre-feet and would provide Minot with a combined degree of protection of 110 years.

6.52 At maximum pool elevation of 1620, the flood pool would have a surface area of 18,900 acres. Damages to existing habitat would be similar in type to those of the recommended plan except that losses sustained by the managed marsh impoundments below the dam would be reduced, while the losses above the dam would be increased due to increased frequency and duration of storage over the recommended plan. It is estimated, based on the surface area of the design pool, that mitigation requirements based on habitat damages would be about 45 percent less than those for the Burlington project. There should also be less refuge mitigation.

6.53 Although this alternative has the greatest benefit/cost ratio (2.16) of any alternative and results in less environmental damage than the recommended plan, it was not recommended because of the low combined degree of protection at Minot. The National Economic Development (NED) plan includes this alternative as the principal feature along with levee upgrading at Velva and three of the seven leveed areas between Burlington and Minot. The NED plan maximizes net economic benefits.

Alternative 8 - Confluence Dam

6.54 A reservoir at the confluence site located near Burlington below the confluence of the Souris and Des Lacs Rivers would have nearly the same environmental effects as alternative 6 except for the additional effects caused by inundation of lands in the Des Lacs River valley and those lands between the Burlington site and the confluence site. The confluence dam would have a storage capacity of 713,400 acre-feet and would provide Minot with protection from about a 0.02-percent chance flood on the Souris and Des Lacs Rivers through complete control of standard project floods from those sources.

6.55 The most important additional environmental damage would be to about 200 acres of mature riparian woodlands and about 800 acres of grassland and cropland upstream of the dam in the Des Lacs and Souris River valleys. Based on a design flood pool of 28,870 acres at elevation 1620, the confluence dam would result in about 23 percent more habitat damage than alternative 6.

6.56 Relocations required along the Des Lacs River would involve rerouting about 7 miles of the main transcontinental line of the Soo Line Railroad and rerouting about 3 miles of U.S. Highway 52 in rugged coulee terrain above the Des Lacs River valley. Additionally, the occupants of 30 medium to low value residences would be relocated to at least comparably safe and sanitary dwellings. Also, the Old Settlers Park would have to be acquired, and the nearby Burlington Cemetery would have to be relocated on higher ground. In addition, the domestic wells at Burlington would require protection during flood periods, and the city's sewage lagoon system would have to be relocated.

6.57 Due to its higher costs (B/C ratio = 1.22) and the adverse environmental and social impacts of this large-dam alternative, it was not selected as the recommended flood control plan.

<u>Alternative 9 - Burlington Dam and Des Lacs Tributary Dams</u>

6.58 This plan involves the Burlington Dam as discussed under alternative 6 in combination with dams on 19 of the coulees tributary to the Des Lacs River. The Des Lacs River coulees are small, with drainage basins varying from about 5 square miles to about 0.25 square mile. The gradients of the coulees are very steep in their lower reaches, ranging up to 60 feet per mile. Accordingly, in order to provide an adequate degree of control over their drainage areas, the dams would require heights ranging from 60 to 100 feet.

6.59 At design pool levels, the 19 impoundments would have a combined surface area of 1,110 acres and would inundate valuable hardwood-shrub communities. Although storage would be fairly short, it is estimated that about 8 percent more habitat would be lost than with alternative 6.

6.60 Only about 7 percent of the total average annual damages at Minot arise from the Des Lacs River. Therefore, the coulee dams would do little to reduce average annual damages at Minot, especially since they would control only about 20 percent of the total Des Lacs River drainage area. The high cost of the coulee dams make this alternative even more economically infeasible with a benefit/cost ratio of 0.74.

<u>Alternative 10 - Recommended Plan</u>

6.61 See discussion elsewhere in this report.

<u>Alternative 11 - Lake Darling Dam and Des Lacs Diversion</u>

6.62 This alternative corresponds to alternative 7, with the addition of a diversion tunnel from the Des Lacs River to the Souris River dam site. The Des Lacs diversion could be comparable to that for the recommended plan presented elsewhere in this document. This alternative would provide Minot with a combined degree of protection from almost a 0.5-percent chance flood.

6.63 It is estimated that habitat damages resulting from this alternative would be about 43 percent less than those occurring with alternative 6. This alternative was not selected, although it was economically feasible with a benefit/cost ratio of 1.20, because the level of protection at Minot was not considered adequate for an urban area of Minot's size.

Alternative 12 - Burlington Dam, Des Lacs Diversion, Gassman Coulee Dam

6.64 This alternative is the same as alternative 10, with the addition of a dry dam at the mouth of Gassman Coulee. This plan would provide Minot with a combined degree of flood protection of about 1,100 years from all sources and has a benefit/cost ratio of 1.18.

6.65 Gassman Coulee has a drainage area of only 35 square miles; however, its potential for causing flooding at Minot is significant in view of its location and the steepness of its drainage area. The gradient of the coulee averages 25 feet per mile. Although a flood from Gassman Coulee has never been experienced (see paragraph 6.86 for discussion of flood on Bonnes Coulee at Velva), a standard project rainstorm centered over the coulee could cause an estimated 10,000 cfs discharge in Minot.

6.66 A dam of any size providing any degree of protection desired at Minot could be placed on the coulee. However, for purposes of comparison with other alternatives, a dam providing standard project flood protection at Minot was considered. The dam would be located approximately one half mile upstream from the mouth of the coulee just below the confluence of the coulee's main stem and south branch. Due to the steep gradient of the coulee, the dam required to provide standard project flood protection would be approximately 100 feet in height. At full design pool, the dam would have about 11,000 acre-feet of storage with a surface area of about 370 acres.

6.67 Significant environmental and social disturbances which would be created by the dam include periodic inundation of about 70 acres of woodland, 230 acres of grassland, and 70 acres of cropland, as well as displacement of rural families and acquisition of private lands. As perceived, the dam would be utilized only for the temporary impoundment of floodwater. Outflow from the dam would be regulated so as not to exceed about 2,000 cfs at the mouth of the coulee. The addition of a dam on Gassman Coulee would reduce the threat of severe damages and loss of life at Minot from extremely rare floods and increase the degree of protection from all potential flood sources. However, a dam on the coulee would not significantly reduce average annual damage at Minot since the coulee rarely produces flows in excess of 5,000 cfs. Accordingly, as a first or last added increment, a dam on the coulee cannot be economically justified.

Alternative 13 - Lake Darling Dam, Minot Diversion Tunnel

6.68 This plan is a combination of alternatives 7 and 5, with the exception that the size of the tunnel beneath Minot would be reduced to 5,000 cfs. This plan is economically feasible, with a benefit/cost ratio of 1.22. The combined degree of protection at Minot is about 520 years because the effective storage is increased over alternative 7 by increasing the maximum controlled discharge from 5,000 cfs to 10,000 cfs. However, release of 10,000 cfs is probably not implementable, due to adverse effects in areas not protected by the structures at Minot.

6.69 Environmental impacts for this alternative would be less than the combination of those for alternatives 5 and 7 since the size of the channel modifications below Minot would be substantially reduced. In going to a 5,000-cfs diversion tunnel, the width of the 22 miles of downstream channel modifications would be reduced an average of 50 feet from the width necessary with alternative 5. Excavation could also be limited to one side of the channel over most of the reach. This would reduce both terrestrial and aquatic impacts associated with alternative 5 by about 65 percent. Impacts in the reservoir area could also be reduced substantially from those identified for alternative 7 if all releases up to 10,000 cfs were permitted before storage.

Alternative 14 - Lake Darling Dam and Flood Barriers

6.70 The features of this alternative are the same as alternative 13 except that the tunnel under Minot would be replaced by levees.

6.71 The existing emergency levees in Minot would be upgraded to pass a flow of 11,000 cfs, approximately equivalent to the peak flow from the standard project storm centered over the uncontrolled drainage area below the mouth of the Des Lacs River. The 11,000-cfs levees would be similar in concept to the 14,000-cfs levees described under alternative 4. At Sawyer and Velva the levees would be designed to pass a peak flow of 14,000 cfs, recognizing local inflow contributions below Minot.

6.72 Assuming that all flows up to 11,000 cfs could be passed through Lake Darling Dam raised to elevation 1620, this alternative would control about an 800-year Souris River flood corresponding to about 80 percent of the standard project flood. The downstream levees would also control a 3,000-year Des Lacs River flood corresponding to about 60 percent of the standard project flood and would completely control all local drainage area floods up to the standard project flood. Recognizing the probability of flow from any source above Minot exceeding 5,000 cfs, this alternative would provide a combined degree of protection of about once in 650 years.

6.73 The cost of alternative 14 is $102.1 million including non-Federal costs of $22.0 million. This alternative is economically feasible with a benefit-cost ratio of 1.32. However, the high local costs, the relatively low degree of protection, and the adverse impacts created in unprotected areas downstream of Minot are major disadvantages of this alternative.

Environmental Quality (EQ) Plan

6.74 In 1973, the Water Resources Council proposed in final form the Principles and Standards for Planning Water and Related Land Resources (P&S) pursuant to Section 103 of the Water Resources Planning Act (Public Law 89-80). The P&S guidelines were subsequently approved by the President and became effective on 25 October 1973.

6.75 According to P&S, "the overall purpose of water and land resource planning is to promote the quality of life, by reflecting society's preferences for attainment of the objectives" of National Economic Development (NED) and Environmental Quality (EQ). In addition to these two main objectives, P&S also recognized that impacts may occur in areas of Social Well-Being (SWB) and Regional Development (RD) and that these effects should be considered during plan formulation and plan selection. Furthermore, P&S requires that at least one alternative plan be formulated that emphasizes contributions to the environmental quality objective.

6.76 The EQ objective, as defined by P&S, is accomplished by enhancing the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems. During the planning process, all alternative plans are formulated in such a manner as to attempt to make positive contributions to alleviate the current and projected problems and needs of the study area. The EQ plan, however, addresses the planning objectives in a way that emphasizes aesthetic, ecological, and cultural contributions more than any other alternative. The EQ plan should also be viable, implementable, and meet evaluation criteria while not violating identified planning constraints.

6.77 The EQ plan is comprised of the following items:

1. A 14,000-cfs diversion tunnel under the city of Minot.

2. A low-head dam upstream of Minot to divert all flows above channel capacity into the diversion tunnel.

3. A low-head dam downstream of Minot to prevent backup of tunnel discharges.

4. Evacuation of the 100-year floodplain or flood proofing below Minot where flood stages are increased due to tunnel discharges and evacuation at Talbot's Nursery, a mobile home area above Minot.

5. Local protection measures at Velva (including upgrading emergency levees and a channel cutoff) and at urbanized areas from Burlington to Minot.

6. Continuation of floodplain regulations downstream from Velva, and enactment of floodplain regulations at Sawyer.

7. Improvements to marsh impoundments on the Upper Souris National Wildlife Refuge (NWR) to permit more efficient refuge operations.

8. Investigation of feasibility of evacuation and/or flood proofing for those structures within the 100-year floodplain of the Des Lacs River and Gassman Coulee and evacuation of rural floodplain residences between Burlington and Minot. If these measures prove infeasible, provision of necessary advisory services to residents in these areas.

9. Operation of the rehabilitated (for safety reasons) Lake Darling Dam for flood control.

6.78 Construction of the upstream diversion structure would result in minor adverse impacts to the natural communities upstream of Minot where the structure would be located (tentatively between the Souris Valley Golf Course and Perkett School). The upstream diversion structure would require about 20 acres and the relocation of up to 30 homes, although this number could be reduced by alternative alignments.

6.79 Upstream from the tunnel exit, a second low-head structure would be constructed to prevent diverted flows from backing up into Minot. This structure would be shorter in length than the upstream structure, would require about 10 acres and would not require any relocations.

6.80 The tunnel would be similar to that described for alternative 4, except that it would be larger to pass up to 14,000 cfs. At its exit, about 1 mile of concrete-lined channel would be necessary to prevent erosion. An energy dissipating structure would also be required at the exit. Extending the channel another 20 miles or so is an alternative to the second low-head structure (paragraph 6.79), but was not chosen because of greater adverse effects upon the stream and floodplain. Such a change would give a plan which is more operable, however.

6.81 Included in the EQ alternative are improvements to the dikes and control structures of the marsh impoundments on the Upper Souris NWR. Improvements to these structures would increase the management capabilities on the refuge and would result in increased production of waterfowl and some other wildlife species on the refuge. This would be achieved through the increased capability for rotational drawdown and/or other water level manipulation of the marsh units and a more rapid return to normal operating levels following flood events.

6.82 From an economic viewpoint, it is assumed that modifications to the refuge marsh structures would result in benefits at least equal to the identified costs. The benefit-cost ratio of the EQ plan is 0.81, based on average annual benefits of $5.14 million and average annual costs of $6.34 million. Total cost of the EQ plan is $111,550,000.

6.83 Also, with the level of flood protection at Minot increased to over 100 years, the pool level of Lake Darling could be maintained at the authorized level of 1598 (2 feet above current operating level) following the spring flood season for waterfowl and fishery management purposes. The ability to maintain Lake Darling at 1598 optimizes marsh management at the upper end of the lake and at the same time increases the water supply capability of the lake.

6.84 While the EQ alternative does not provide as high a degree of flood protection from floods originating on the upper Souris River as do those alternatives that contain a large dam on the Souris River, the degree of protection from those areas with rapid runoff is increased over many other alternatives. The EQ alternative provides Minot with a degree of protection from all sources of about 110 years. From those areas of rapid runoff, i.e., Gassman Coulee and Des Lacs River, the degree of protection is to the level of the 0.02 percent chance flood. The EQ plan has attempted to reduce the chance of economic flood losses in Minot to an acceptable level while maximizing protection from those sources from which emergency protection would be ineffective.

6.85 Historically, flooding has usually been the result of the Souris River runoff above the confluence with the Des Lacs River. The runoff characteristics for the Souris River, however, are such that several weeks' advance notice is available, which provides time for emergency protection measures. To date, the flood of record was in 1976 and had a peak discharge probability of about once in 80 years. On the other hand, flood peaks from the Des Lacs River and Gassman Coulee have been much less, but runoff is extremely rapid. For example, the standard project flood on Gassman Coulee would be expected to peak in Minot after only about 20 hours.

6.86 The Gassman Coulee lies only about 2.0 river miles above Minot and an intense rainstorm centered over its basin could result in serious loss of life in addition to large economic damages. While the possibility of a large flood on Gassman Coulee is remote, the only event of Standard Protection Flood proportions in the basin occured on a coulee similar in size to Gassman Coulee. Bonnes Coulee, near Velva, experienced an intense rainfall event on 10 August 1962 when up to 10.5 inches of rain was reported in a period of about 4 hours. The average rainfall on the 46-square-mile area of Bonnes Coulee was estimated at 6.2 inches while the peak discharge was estimated to be from 12,000 to 23,000 cfs. Such an event on Gassman Coulee could result in a catastrophe. Once the flat Souris River floodplain is reached, velocities would lower substantially, but peak stage in the Souris valley would occur, and reach Minot, much faster than peaks from the slow-rising Souris River (and thus allow little warning).

6.87 Besides attempting to exert maximum control over flooding which causes large economic damages, assessment of the adequacy of flood control also considers flood hazard in a more general sense. Hazard is a function of its three components:

a. Exposure. Frequent and/or large (especially if both in stage and duration) floods, such as those from the Souris River, maximize exposure.

b. Severity. High floodwater velocities and rapid peak buildup, such as Gassman Coulee floods, maximium severity.

c. Effectiveness of control. Ineffective control increases hazard.

The EQ plan exhibits a high degree of control for Minot over the severity component of hazard, i.e., Gassman Coulee floods. Its effectiveness is good for the more severe floods from Gassman Coulee, the Des Lacs River, and local uncontrolled drainages. Its effectiveness is relatively low for large Souris River floods, however, and the EQ plan therefore does not have a high degree of control over exposure. The EQ plan also loses control rapidly once design flows are exceeded, unlike the dam alternatives which continue to attenuate even the larger floods.

6.88 Local protection is proposed for those urbanized areas within the 100-year floodplain between Burlington and Minot. At present, the subdivisions in this reach are protected to some degree by emergency levees. It is envisioned that these structures would be upgraded to provide 1-percent flood protection. The only exception in this reach would be the area known as Talbot's Nursery. This area is a trailer court and it is only logical that the mobile homes be relocated to an area outside the 1-percent floodplain.

6.89 At the downstream community of Sawyer, the EQ alternative includes adoption of floodplain regulations and flood insurance. At present, emergency levees afford Sawyer some level less than 1-percent flood protection. It is proposed that Sawyer adopt floodplain regulations consistent with the Federal Insurance Administration's guidelines and so become eligible to participate in the flood insurance program.

6.90 At Velva, a combination is proposed of channel modifications, channel cutoff, and permanent levees to provide the area with a 1-percent level of protection. At present, Velva also has emergency levees.

6.91 In the rural areas below Minot, evacuation or flood proofing is proposed where operation of the Minot tunnel results in a significant increase in flood stage and duration. Easements on lands flooded for an extended duration, or newly flooded, would also be required.

6.92 For areas in the Des Lacs River and Gassman Coulee floodplains, evacuation or flood proofing is proposed where economically feasible. In other cases, floodplain regulations would be enforced and technical assistance would be provided for those willing to bear the costs of relocation/flood proofing themselves.

6.93 When operating the tunnel for flood control, constantly updated flood forecasts would be required. At the onset of a runoff event, flows would be permitted to flow through the Minot channel until near capacity. At that point, all flows would be diverted through the tunnel up to its capacity of 14,000 cfs. If current forecasts predicted flows in excess of 14,000 cfs, a decision would be made to open the diversion gates to again allow flows to pass through Minot. This would be necessary to prevent overtopping and potential failure of the diversion structure which could flood the city in a "wall" of water. By opening the control gates, the city would also be flooded, but the damages sustained would be much less than if the structure were overtopped and failed. Nevertheless, opening the gates would be a difficult decision, and probably impractical in [illegible] but the [illegible] situation. The problem would be hydrologically similar to the [illegible] evacuation behind a levee when the levee is in jeopardy, or [illegible] opening the gates on a gated dam spillway; but opening the gates at Minot would have greater social consequence because it would [illegible]

6.94 The EQ alternative is not without adverse impacts to the natural environment. These adverse impacts are related to upgrading emergency levees, disturbances in areas selected for relocations, channel modifications necessary at local protection sites and downstream from the tunnel, construction of the diversion and check dams, and disposal of excavated material. Local protection from the 1-percent flood would require larger structures than with the recommended plan. However, these impacts are to a large degree temporary in nature and/or would occur in areas already greatly disturbed by man.

6.95 The EQ alternative would require no mitigation for environmental losses since there would be a net positive contribution to the environment, as opposed to a net loss for almost every other structural alternative.

6.96 Several positive social impacts would result from the implementation of the Environmental Quality Plan. Section 122 of the Flood Control Act of 1970, Public Law 91-611, states that a necessary consideration in the final decision-making process of a project is the extent of "destruction or disruption of man-made and natural resources, aesthetic values..." Additionally, the Water Resources Council, Principles and Standards for Planning Water and Related Land Use Resources, 1973, identified Social Well-Being effects as, in part, those effects of a plan on educational, cultural and recreational opportunities. Positive contributions of the EQ plan

to the Social Well-Being account include the preservation and enhancement of the Upper Souris National Wildlife Refuge. This area adds to Social Well-Being in the aesthetic and recreational opportunities it provides, including park recreation, photography, bird and waterfowl hunting, etc.

6.97 The EQ plan avoids several adverse impacts present with other alternatives. Under the EQ plan, it is expected that relocation, levee protection, or raising (headstones) in place for 248 graves at McKinney Cemetery would not be necessary. The cemetery is not within the 100-year floodplain or Lake Darling flood pool. However, project structures and the flood pool created by several of the alternate plans would necessitate structural work at the cemetery. The EQ plan would also not require the relocation of 25 rural and ranch residences, mostly between the proposed dam and Baker Bridge. Generally these residences, like the McKinney Cemetery, are not now within the floodplain. Many residents are lifetime occupants of their present homes and their ancestors occupied these lands for several generations. These residents are not threatened by flood problems, and would reap no benefits from alternatives that require them to be relocated, yet would bear substantial social and psychological burdens from those alternatives. Additionally, purchase and removal of 80 seasonal residences and several recreational buildings in Renville County Memorial Park would not be required by this plan.

6.98 The EQ alternative does create several adverse social impacts. The plan would require the relocation of mobile homes upstream from Minot. However, these structures are within the present floodplain, indicating that the social costs of relocation would not be imposed upon residents who would receive no benefits from an area flood control project. An additional adverse social impact of the EQ plan would occur with the likely conclusion that the project would be considered a local flood control project. In this eventuality the city of Minot would be assessed approximately $10 million in local cost-sharing charges. This would obviously place a substantial burden upon the community. However, it would be consistent with regulatory guidelines, since it would represent a more equitable distribution of costs and benefits. The Principles and Standards (P&S) for Planning Water and Related Land Resources address cost-sharing requirements in the following manner: "Reimbursement and cost-sharing policies shall be directed generally to the end that identifiable beneficiaries bear an equitable share of cost commensurate with beneficial effects received..." Accordingly, the assessment of cost-sharing responsibilities upon Minot, while substantial and institutionally unacceptable (to Minot), is recognized as equitable.

6.99 From the perspective of social well-being, the objectives of any planning alternative are 1) to minimize the individual and social hazards attendant upon flooding by providing an adequate level of flood protection, and 2) to maximize the equitable distribution of sacrifices and gains among individuals and groups.

6.100 In summary, the EQ plan provides adequate control over the severity component of flood hazard, is marginal with respect to exposure, and is in the mid range in terms of effectiveness of control. The EQ plan yields more positive contributions than detrimental effects to social well being, and is therefore regarded as a socially acceptable plan because it confers economic, social and flood control benefits upon those who would be obligated to sacrifice property ownership, modes of orientation to work and family, and other value commitments for an increased protection from flooding. The EQ plan is not economically feasible, having a benefit-cost ratio of 0.83.

6.101 The EQ plan is expected to make substantial contributions to the Regional Development account and have substantial local employment benefits. The reasons are that:

1. The overall project cost is high, with a corresponding large amount of economic and construction activity.

2. The kinds of construction would be more varied than with any other plan, thus spreading benefits over a wider sector of the population.

3. Small firms, many of with are local, would be able to bid on the many small jobs in the EQ plan. Only the nonstructural alternatives may rank higher in this regard.

6.102 The EQ plan was not selected because it lacks economic feasibility and provides inadequate protection from Souris River floods originating in Canada.

National Economic Development (NED) Plan

6.103 From the national point of view, the NED plan must provide the best return on the investment of economic resources, including capital, labor, and irreplacable resources needed for continuation, while addressing the specific planning objectives. In developing the NED plan, only those features are included which provide benefits greater than the costs of the features.

6.104 An analysis of the benefits, costs, and net benefits of a range of plans indicated that the plan which would provide a maximum of excess benefits over costs would involve a dam at the Lake Darling site (plan 7) providing 383,000 acre-feet of flood control storage to elevation 1620, and levees in three of seven subdivision areas between Burlington and Minot and at Velva (designed to pass a flow of 5,000 cfs plus 3,000 cfs local inflow at Velva). The NED plan would provide approximately 100-year flood protection at Minot and the other urban areas protected by levees. The NED plan (plan 7 as modified), would provide a maximum of benefits over costs but would not provide an acceptable level of protection.

Table 24: Impacts of Alternative

Item	1 No action (base condition)	2 Floodplain evacuation	3 Souris River diversion	4 Flood barriers	5 Minot diversion tunnel	6 Burlington Dam	7 Lake Darling Dam
Physical data							
Usable flood storage capacity (acre-feet)							
Souris River	-	-	-	-	-	633,000	383,000
Des Lacs River	-	-	-	-	-	-	-
Gassman Coulee	-	-	-	-	-	-	-
Diversion capacity (cfs)							
Boundary diversion	-	-	9,000	-	-	-	-
Des Lacs diversion	-	-	-	-	-	-	-
Minot diversion	-	-	-	-	9,000	-	-
Levee capacity (cfs)							
Burlington to Minot	-	14,000	5,000	14,000	14,000	5,000	5,000
Minot	-	14,000	5,000	14,000	5,000	5,000	5,000
Sawyer	-	17,000	8,000	17,000	17,000	8,000	8,000
Velva	-	17,000	8,000	17,000	17,000	8,000	8,000
Degree of protection (at Minot) (frequency in years and percent SPF)							
Upper Souris River	20	100	100 (26-35%)	100 (26-35%)	100 (26-35%)	2,500 (75-86%)	500 (54-64%)
Des Lacs River	250 (25%)	- (70%)	250 (25%)	- (70%)	- (70%)	250 (25%)	250 (25%)
Local drainage areas	300 (44%)	- (100%)	300	- (100%)	- (100%)	300 (44%)	300 (44%)
Upper Souris and Des Lacs Rivers	18	100	70	100	100	230	160
Combined - all sources	18	100	68	100	100	130	105
Residual SPF flow at Minot (cfs)							
From Upper Souris River	43,000	43,000	34,000	43,000	43,000	10,700	22,000
From Des Lacs River	20,000	20,000	20,000	20,000	20,000	20,000	20,000
From local drainage area	11,400	11,400	11,400	11,400	11,400	11,400	11,400
Economic impacts							
Federal first costs ($million)	-	221.50	309.87	38.53	86.32	77.30	57.03
Non-Federal first costs ($million)	-	44.45	-	29.80	4.17	-	-
Total first costs ($million)	-	265.95	309.87	68.33	90.49	77.30	57.03
Average annual costs ($million)	-	13.75	17.61	3.90	5.17	4.68	3.39
Average annual benefits ($million)	0	8.83	5.90	5.49	5.14	7.56	7.32
Benefit-cost ratio	-	0.64	0.34	1.41	0.99	1.62	2.15
Net average annual benefits ($million)	-	-4.92	-11.71	1.59	-0.03	2.88	3.93
Average annual residual damages ($million)	7.18	0.86	1.80	1.44	1.72	0.65	0.86
Percent reduction in average annual damages	0	88	75	80	76	91	88
Damages at Minot from SPF ($million)							
From Upper Souris River	100.00	17.00	95.00	95.00	95.00	53.00	94.00
From Des Lacs River	74.00	12.00	74.00	46.00	46.00	74.00	74.00
From local drainage area	33.00	0	24.00	0	0	33.00	33.00
Number of displacements							
Rural							
Farm	-	25	10	-	-	18	16
Nonfarm	-	70	2	3	-	12	5
Summer homes	-	-	-	-	-	75	75
Urban							
Residences	-	4,000	-	270	[illegible]	-	-
Businesses	-	350	-	-	-	-	-
Schools	-	8	-	-	-	-	-
Churches	-	15	-	-	-	-	-
Number of severed property owners	-	-	75	-	-	75	50
Parks affected	-	-	-	-	-	2	2
Cemeteries affected	-	-	-	-	-	1	1
Agricultural lands adversely affected (acres)	-	-	9,000	-	50	8,950	5,230
Number of road crossings affected	-	-	3	15	7	13	10
Adverse effect on school districts	-	Minor	Minor	No	No	Yes	Yes
Loss of tax base	No	Minor	Yes	No	No	Yes	Yes
Environmental impacts							
Refuge lands affected (acres)							
Open water	-	-	-	-	-	10,800	9,200
Wetlands	-	-	-	-	-	3,200	1,560
Woodlands	-	-	-	-	-	850	620
Croplands	-	-	-	-	-	1,070	560
Grasslands	-	-	-	-	-	3,560	2,740
Other	-	-	-	-	-	20	20
Total	-	-	-	-	-	19,500	14,700
Private lands affected (acres)							
Open water	-	-	-	-	-	230	140
Wetlands	-	-	200	-	100	840	380
Woodlands	-	-	100	-	100	520	200
Croplands	-	-	5,000	-	[illegible]	2,560	1,510
Grasslands	-	-	4,000	-	-	1,760	520
Other	-	-	200	150	50	90	50
Total	-	-	9,500	150	300	6,000	2,790
Mitigation costs ($thousands)(A)	-	100	1,000	15	309	8,575	5,868
Fishery resources affected							
Stream (miles)	-	-	-	37	27	62	47
Lake (acres)	-	-	-	-	-	10,000	9,000

(A) [illegible] percent compensation for habitat losses. Actual mitigation costs may vary.

Plans

8 Confluence Dam	9 Burlington Dam and dams on Des Lacs River tributaries	10 Burlington Dam and Des Lacs River diversion tunnel	11 Lake Darling Dam and Des Lacs River diversion tunnel	12 Burlington Dam, Des Lacs River diversion tunnel, Gassman Coulee Dam	13 Lake Darling Dam and Minot diversion tunnel	14 Lake Darling Dam and Minot flood barriers	LD	NED
686,000	633,000	633,000	383,000	633,000	383,000	383,000	-	383,000
27,000	32,000	-	-	-	-	-	-	-
-	-	-	-	11,000	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	4,500	4,500	4,500	-	-	-	-
-	-	-	-	-	5,000	-	14,000	-
5,000	5,000	5,000	5,000	5,000	10,000	11,000	14,000	5,000
5,000	5,000	5,000	5,000	5,000	5,000	11,000	5,000	5,000
8,000	8,000	8,000	8,000	8,000	8,000	14,000	17,000	8,000
8,000	8,000	8,000	8,000	8,000	8,000	14,000	17,000	6,000
3,300 (95%)	2,500 (75-86%)	2,500 (75-86%)	500 (54-64%)	2,500 (75-86%)	770 (75-86%)	800(75-86%	100(26-35%)	500(54-64%)
- (100%)	550 (30%)	2,000 (70%)	1,500 (60%)	2,000 (70%)	3,300 (50%)	3,300(55%)	- (70%)	250(25%)
300 (44%)	(100%)	300 (44%)	300 (44%)	(100%)	5,000 (90%)	- (100%)	- (100%)	300(44%)
3,300	450	1,100	400	1,100	620	650	100	160
280	450	240	170	1,100	560	650	100	105
7,000	10,700	10,700	22,000	10,700	15,000	14,000	43,000	22,000
5,[illegible]	16,000	11,000	11,000	11,000	20,000	19,000	20,000	20,000
10,800	10,800	11,400	11,400	8,000	11,400	10,400	11,400	11,400
106.87	171.95	92.60	107.0	110.54	107.70	80.15	104.58	51.26
-	-	-	-	1.34	2.53	21.96	6.97	-
106.87	171.93	92.60	107.0	111.88	110.23	102.10	111.55	51.26
6.40	10.21	5.60	6.40	6.70	6.39	5.92	6.34	3.09
7.80	7.60	7.76	7.70	7.90	7.82	7.82	5.14	7.26
1.22	0.74	1.39	1.20	1.18	1.22	1.32	0.81	2.35
1.40	-2.61	2.16	1.30	1.20	1.43	1.90	-1.20	4.17
0.50	0.57	0.50	0.57	0.43	0.50	0.50		
93	92	93	92	94	93	93	76	88
20.00	53.00	53.00	94.00	53.00	50.00	50.00	95.00	94.00
0	68.00	46.00	46.00	46.00	53.00	53.00	46.00	74.00
29.00	29.00	33.00	33.00	17.00	5.00	5.00	0	33.00
20	20	18	16	18	16	16	15	16
30	25	12	5	12	5	5	45	5
75	75	75	75	75	75	75	-	75
30	-	-	-	-	3	250	51	-
-	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
100	80	76	52	77	50	-	-	50
3	2	2	2	2	2	2	-	2
2	1	1	1	1	1	1	-	1
12,030	9,960	9,160	14,610	10,300	5,260	5,230	-	5,230
14	14	14	11	15	17	25	3	10
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Minor	Yes
10,800	10,800	10,800	9,200	10,800	9,200	9,200	-	9,200
3,200	3,200	3,200	1,560	3,200	1,560	1,560	-	1,560
850	850	850	620	850	620	620	-	620
1,070	1,070	1,070	560	1,070	560	560	-	560
3,560	3,560	3,560	2,740	3,560	2,740	2,740	-	2,470
20	20	20	20	20	20	20	-	20
19,500	19,500	19,500	14,700	19,500	14,700	14,700	-	14,700
240	230	235	145	235	150	150	-	140
900	840	860	400	860	440	440	-	380
700	1,000	580	350	650	370	370	-	290
4,200	2,900	2,730	1,640	2,[illegible]	1,540	1,540	-	1,510
3,200	2,430	1,850	510	2,[illegible]	420	420	-	570
100	100	95	55	100	80	160	-	50
9,[illegible]	7,[illegible]	6,350	3,100	6,720	3,000	3,000	30	2,700
9,0[illegible]	8,761	8,632	5,915	[illegible]	5,968	5,968	30	5,968
							-	
70	62	63	48	63	74	74	-	47
10,[illegible]	10,000	10,000	9,000	10,000	9,000	9,000	-	9,000

7.00 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.01 The primary purpose of this section of the EIS is to identify and assess the cumulative and long-term effects on the environment that would occur from implementation of the proposed action.

7.02 Water resources planning also involves identification of planning objectives and constraints and the analysis of tradeoffs in light of current economic, environmental, and social awareness. Tradeoff analysis, which is dictated by the P&S (Principles and Standards for Planning Water and Related Land Resources Projects, approved by the President on 5 September 1973), is a concept formulated after the National Environmental Policy Act (which required the EIS) was passed. Therefore, there is no designated place in the EIS for a discussion of tradeoff analysis. Given the primary objective of this section, however, tradeoff analysis logically fits here and is interwoven in the discussion that follows.

7.03 Under the guidelines of P&S, Federal participation in water and land resource planning requires that plans "will be directed to improvement in the quality of life through contributions to the objectives of national economic development (NED) and environmental quality (EQ)." Furthermore, "when any plan is recommended from among alternative plans, there is an implicit expression of what is considered to be the affected group's priorities and preferences."

7.04 Components of NED are well known and essentially relate to the benefit/cost ratios developed for each alternative. These have been the principal force behind most water resource projects to date. The co-equal national objective of EQ is, however, less well defined, due in part to its more qualitative nature, and includes the following:

(1) Management, protection, enhancement, or creation of areas of natural beauty and human enjoyment such as open and green space, wild and scenic rivers, lakes, beaches, shores, mountains and wilderness areas, and estuaries.

(2) Management, preservation, or enhancement of especially valuable or outstanding archaeological, historical, biological (including fish and wildlife habitat), and geological resources and ecological systems..

(3) Enhancement of quality aspects of water, land, and air by control of pollution or prevention of erosion and restoration of eroded areas.

(4) Avoiding irreversible commitments of resources to future uses.

7.05 The Burlington Dam project was authorized in 1970, a year following the only significant flood in the previous 65 years, 1 year after the enactment of the National Environmental Policy Act, and prior to development of the P&S. As such, its sole purpose was to provide flood damage reduction for the Souris River basin essentially within economic constraints. The present Phase I reformulation and the concurrent Phase II studies (advanced engineering and design) were directed toward those alternatives involving a dam on the Souris River along with various additional features designed to increase the level of flood protection at Minot.

7.06 The P&S require that alternatives be formulated which attempt to maximize contributions to NED and EQ as well as providing a "mix" of NED and EQ components. The recommended plan is selected from the resulting array of alternatives. Project planning under the P&S does not merely display impacts and arrive at appropriate mitigatory measures.

7.07 Within the Souris River basin there exist several areas of unique environmental quality that are of critical national significance, namely, three national wildlife refuges. These resources are inextricably tied to the health and quality of man's life. Sufficient national and international attention has been focused on them to require passage of Federal laws to create them (using hunting license fees) and to protect and enhance their value. Although the level of management could be increased in these areas to enhance their ecological systems, it has been at a low intensity. The recommended plan would lead to the degradation and perhaps the demise of at least the Upper Souris NWR through significant adverse impacts, some of which are unmitigated under the recommended plan.

7.08 At full pool elevation of 1620, 4,035 acres of riparian marsh (manmade and natural), 1,365 acres of high quality and scarce bottomland hardwoods, 5,321 acres of native and tame grasslands (including woody coulees), and 3,624 acres of agricultural land and cultural features would be adversely impacted. The actual extent of the environmental damages within the flood storage pool would depend upon the frequency and duration of inundation, and other factors.

7.09 The areas above Lake Darling Dam, up to elevation 1605, would be the most seriously impacted since this area has been designated for storage of floods up to about the 1-percent event. The onset of damages between the two dams would probably be delayed, relative to the damages above Lake Darling Dam. However, once storage behind Burlington Dam occurs, the damages to much of the existing vegetational communities will essentially be permanent, since damages would be severe and since the recovery time would be greater than the expected storage recurrence. Hardwood and grassland communities would be the most seriously impacted with little possibility of a return to their current conditions.

7.10 In a State with only about 400,000 acres of natural woodlands remaining (less than any other State), the loss of 1,365 acres of high quality bottomland hardwoods is highly significant. Within Ward County, this acreage represents about 27 percent of the woodlands, including wooded pastures. This loss of bottomland hardwoods would cause a serious alteration to the biological productivity, ecological balance, and stability of the floodplain forest and functionally related ecosystems. Native grasslands are apparently more common in North Dakota, but the refuge grasslands are unusual in their quality and expanse. They are enhanced by other biotic communities and refuge management which result in an unusually complete assemblage of associated wildlife species.

7.11 Riparian marsh communities would probably remain viable, but their current productivity would be much reduced and their management schedules would be disrupted. Depending upon land acquisition practices, agricultural lands within the flood storage pool could revert to successional communities or remain in their present condition during non-storage years.

7.12 Downstream from Burlington Dam, sustained high release flows during the summer, fall, and winter following storage of large floods would reduce the management capabilities on J. Clark Salyer NWR, resulting in reduced wildlife production for several years following such an event.

7.13 Floodplain communities receiving downstream flood protection would gradually be replaced by plant and animal communities characteristic of drier conditions and/or their productivity would be reduced. Floodplain forest and grassland communities in these downstream reaches evolved in response to the existing flood patterns. Reduction in the frequency, duration, and area flooded will result in these changes.

7.14 In arriving at a recommended plan it is necessary to identify the contributions of each plan so that what is gained or foregone with each alternative is clearly set forth and so that tradeoffs can be effected between the degree of fulfillment of the various project objectives. It is important in this respect that, in addition to various modifications and levels of mitigation, alternatives should be formulated which provide various degrees of contributions to the objectives of NED and EQ. The tradeoff analysis involves subjective judgments tempered by public input so that alternatives which are acceptable to major segments of the public are identified. Because priorities and preferences vary, it is unlikely that complete agreement will be reached among all interests as to the relative tradeoffs between objectives.

7.15 Other than the designated EQ plan, there are no alternatives that enhance the existing EQ resources in the study area.

7.16 In an effort to provide the highest economically feasible degree of protection (within the identified planning constraints) for those interests in the Minot area who occupy the Souris River floodplain, an alternative has been selected that would significantly alter the ecological balance of the upper Souris River basin, reduce the natural productivity of the floodplain along about 250 miles of river, and reduce the management efficiency of two national wildlife refuges.

7.17 The majority of the public within the Soutis River valley favor a large dam with a high degree of protection. This is to be expected because the project beneficiaries, i.e., the city of Minot and other urban areas, represent about 93 percent of the floodplain residents.

7.18 A different approach might have defined the dam as a "reservoir in lieu of local protection," the rationale being that Minot receives about 93 percent of the identified benefits. Had this latter approach been followed, the support Minot has expressed for the recommended project would be more meaningful from the standpoint of tradeoffs. The present generation, which in this case consists overwhelmingly of the residents of the Minot area, as trustee for the valley and its environmental attributes, has foreclosed options and narrowed the range of beneficial uses of the valley by their decision to commit a part of it to flood control at this time. It must be pointed out that one of the factors bearing on local acceptability is the financial share which they must bear for project construction and continued operation and maintenance. The Burlington Dam was more attractive, from that standpoint, than local protection.

7.19 The valley interests upstream from Burlington Dam receive no direct benefits from the proposed action. On the contrary, they would experience the most severe adverse impacts and would have to be satisfied with some level of mitigation for their losses for the benefit of downstream interests. In this regard, the USFWS has accepted proposed refuge modifications (including a 4-foot raise of Lake Darling Dam) and habitat mitigation (2,000 acres of reclaimed wetlands and 1,000 acres of tree planting) to compensate for losses anticipated from construction and operation of the project.

8.00 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION

8.01 The energy (hydrocarbon fuels), labor and materials (sand, gravel, steel, etc.) needed for the construction of the proposed flood control project represent an irretrievable commitment of natural resources. However, the energy and resources required to implement emergency works and to rehabilitate floodplain developments would have to be deducted from the energy and resources needed to construct the project in order to determine net long-term effects on the natural resource base. Periodic inundation of Upper Souris River valleylands would result in habitat or land-use changes which is considered an irretrievable commitment of natural resources. For instance, the wooded fringe along the Souris River between Burlington and Lake Darling would be altered from an ecosystem now including many mature trees to an early successional stage comprised of dense weeds with possible later growth of small trees and shrubs. Wildlife species composition would also change. The land needed for the dam and other structures would be committed for flood control use. As a result, much of this acreage would no longer produce floodstuffs. Also, periodic inundation would result in changing the management plan for the Upper Souris National Wildlife Refuge, particularly during and following the period of refuge inundation.

8.02 The selected plan strongly encourages zoning of the residual floodplain between Burlington Reservoir and the J. Clark Salyer Refuge. This provision must be adopted under law anyway, since, in accordance with the provisions of Public Law 93-234, any community now accepting Federal aid for flood control purposes must first adopt floodplain regulations, provide for enforcement procedures of the regulations, and encourage local residents to participate in the flood insurance program.

8.03 In regard to the floodplain below Burlington, the provision of a high degree of flood protection probably will enhance land values and accelerate economic growth, particularly in the suburban areas both upstream and downstream from Minot. In the absence of the project, economic growth would take place, but at a lesser rate, in view of the restrictions imposed by the Flood Disaster Protection Act of 1973 (Public Law 93-234).

8.04 The assessment of irreversible and irretrievable commitments of resources requires a consideration of the effects project actions have upon social factors. A decision which has impacts upon elements of the social and value systems in a project area (like decisions having effects upon natural ecosystems) may not be remediable. One such impact which should be recognized is that the relocation of residences will involve irreversible and irretrievable change in the local social system. The proposed plan will require the purchase of 80 seasonal residences and several recreation structures in Renville Park, as well as the relocation of approximately 25 farms and rural residences. Whether these changes will be perceived by local people as a positive or negative commitment of social resources in the long term of project life is not soundly predictable.

[illegible] Social well-being factors will be irremediably affected through the disturbance of life patterns and the impairment of a sense of family continuity in a specific place. Loss of ties to long-occupied land are also of importance to rural residents who, through farming or ranching pursuits, have developed a sense of history and affective attitudes and values which extend beyond the material utility of lands and structures.

8.06 These affective social and psychological orientations to an immediate place must be recognized as factors which are not mitigated by compensatory economic programs. Because of this understanding, these concerns are important considerations in the assessment of adverse impacts involving irreversible and irretrievable commitments.

9.00 COORDINATION

9.01 Coordination of Phase I General Design Memorandum studies included, as a first step, the formation of a citizens advisory committee. The 12-member committee was comprised of representatives of various State and local groups concerned with the flood problems in the Souris River basin and included representatives of the Ward County Water Management District, the Ward County Board of Commissioners, the cities of Minot and Velva, the North Dakota State Water Commission, and ranchers from both the upper and lower Souris River areas and the Des Lacs River area. The principal objective of the committee was to review alternative solutions to the flood problems in the Minot area and, based on a consideration of all effects, both favorable and unfavorable, to reach a consensus regarding the scope and nature of the flood control plan considered to be in the best public interest. During a time span of about 10 months, the committee held 16 meetings where it evaluated the relative merits of the various flood damage reduction alternatives with technical guidance provided by representatives of the St. Paul District, Corps of Engineers. The meetings were open to the public and were attended by local citizens as well as representatives from various agencies, organizations, and institutions, including the U.S. Fish and Wildlife Service, Bureau of Reclamation, the Souris-Red-Rainy River Basins Commission, Minot State College, and the Izaak Walton League of America. The meetings culminated with the adoption of a position paper by the committee, covering 17 proposals they agreed should be taken into account in the final plan recommended by the Corps of Engineers (see appendix D of Phase I General Design Memorandum).

9.02 On 19 February 1974, following completion of the first draft phase I report and the environmental impact statement, a public meeting was held in Minot to discuss the overall planning effort, including alternatives investigated and the recommended plan. At this meeting, which was attended by 500 citizens, ranchers from the upper Souris River valley and representatives from the local chapter of the Izaak Walton League of America voiced strong objections to the proposed reservoir plan on the basis of social and environmental degradation. The city of Minot continued to strongly support the project, as evidenced by a statement made at the public meeting by the mayor of Minot.

9.03 At the request of the citizens advisory committee, the Bureau of Reclamation analyzed the feasibility of utilizing floodwater storage for irrigation and found that the expected irrigation benefits would not justify the associated costs because of the infrequent storage and availability of floodwaters for irrigation use.

9.04 In a December 1972 letter, the U.S. Fish and Wildlife Service expressed its views on early alternative reservoir sites, operating plans, and mitigation to offset wildlife habitat losses. The Fish and Wildlife Service objected to reservoir sites which caused adverse impacts on the refuge units below Lake Darling and suggested only a raise of Lake Darling Dam, which would negate any effects below the dam and least affect

the overall environment of the upper Souris River valley. They favored reservoir operation providing for a high release during spring, a relatively late cutoff date, and a low summer release rate to minimize adverse impacts on both the Upper Souris National Wildlife Refuge and J. Clark Salyer Refuge. This objection by the Service continued during the ensuing years although efforts to resolve disagreements were made at local and Washington level meetings and through exchange of correspondence. The Fish and Wildlife Service was requested to furnish data defining effects of the proposed alternative plans on fish and wildlife. They stated that gathering sufficient data to describe effects of the proposed reservoir siting and operation on fish and wildlife habitat in the upper and lower refuges would require at least a 1-year study.

9.05 Subsequently, the Fish and Wildlife Service undertook a study with the St. Paul District, Corps of Engineers to determine the impacts of alternative plans on habitat values. Results of these studies culminated in the development of mitigation features for the selected plan outlined in a U.S. FWS report dated 25 April 1977 and supplemented by a letter dated 8 September 1977 (see Exhibits 3 and 4 of the technical appendix in the final EIS).

9.06 More recently, meetings were held with State and local interests to discuss the plan accepted by the Fish and Wildlife Service. In May 1976 and 26 January 1977, the Governor of North Dakota was briefed on the project. The Governor expressed concern about the impact of the project on private rural lands and developments and requested that meetings be held with local interest groups to obtain their views on the project. In response to the Governor's request, 10 meetings were held with local interests in the Souris and Des Lacs River valleys during February and March 1977. The meetings were held at Sherwood, Mohall, Carpio, Minot, Sawyer, Velva, and Towner and were specifically directed toward discussion of the impacts the project would have on the particular local area. An average of 50 people attended each meeting which was open to the public. As a result of concerns expressed at the meetings, more intensive consideration was given to acquisition of flowage easements in lieu of fee title purchase of lands in the reservoir area to minimize the impact of the project on the rural economy, particularly in Renville County which would receive no benefits from the project. Also, the meetings resulted in the addition of three road raises to the project and modifications to the reservoir plan of operation to provide flood damage reduction benefits in rural areas below Minot from the more frequent smaller floods. All of the added measures are in agreement with the Governor's policy of minimizing impacts of the project on private rural interests, as outlined in his four-point policy program on the Souris River flood control study.

9.07 On 15 April 1977 an area-wide public meeting was held in Minot to obtain the further views of the public on the plan. The meeting was attended by 1,820 people and received local, State and national news coverage. At the meeting, 123 statements were delivered by those in favor of the project and 66 statements were delivered by those in opposition to

the project. In addition, petitions bearing 5,500 signatures, mostly from the Minot area in favor of the project, and 3,500 signatures from rural areas outside of Minot in opposition to the project, were presented at the meeting. The State of North Dakota and the city of Minot again voiced strong support for the project as evidenced by statements delivered at the public meetings.[1]

9.08 In June 1977 the Governor and the State Natural Resources Council were briefed on the issues raised at the public meetings and the changes made to the plan resulting from the meetings. The governor was again briefed on project modifications and international aspects in September 1977.

9.09 In addition to the public involvement meetings, two meetings were held with the McHenry County Board of Commissioners and the Water Management Board to review the details of the reservoir operation plan. Meetings were also held with the Renville County Board of Commissioners, Renville County Park Board, McKinney Cemetery Association, Upper Souris Rural Water Users Association, and the Ward and Bottineau County Boards of Commissioners.

9.10 In compliance with Council on Environmental Quality requirements, the Souris Basin Planning Council and the city of Minot were contacted regarding land use plans. (See also section 3 of the final EIS.)

9.11 In its initial review of the project document plan in 1969, the Souris-Red Rivers Engineers Board recommended to the International Joint Commission that construction of the channel modification through Minot proceed since it would have no significant impact on flows in Canada. However, the Board recognized possible adverse effects in Saskatchewan due to backwater at design full-pool level above Burlington Dam and both beneficial and adverse effects in Mantitoba due to storage and subsequent release of floodwaters. On the basis of the latter finding, the Board recommended that construction not be initiated on Burlington Dam until the issue of effects in Canada was equitably resolved and that the Board be authorized to undertake further studies to determine the nature and extent of such effects. The Commission concurred in the Board's findings and directed that the further studies be undertaken. Accordingly, to assess the impacts of the project on Canada, in September 1970 the Board established the Burlington Task Force, consisting of two members each from Federal water resources agencies in the United States and Canada. Upon completion of the study, the task force was charged with submitting to the Board copies of its report covering all aspects and findings of the study.

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1 Transcripts of the 19 February 1974 and 15 April 1977 public meetings are available for review in the St. Paul District, Corps of Engineers office.

9.12 Early Phase I studies recognized the international problems. Thus, the plan was modified by reducing the maximum storage level above Burlington Dam 2.2 feet to elevation 1620 and increasing the release rate during major flood occurrences from 2,300 to 5,000 cfs, materially decreasing the probability of storage to full-pool level and largely eliminating the concerns of Canada regarding adverse effects in Saskatchewan. Also, the reservoir drawdown rate after 15 May was modified to not exceed a 500-cfs flow at Minot, rather than the rate of 2,300 cfs proposed in the project document. The task force held several meetings to review study progress, including evaluation of hydrologic routing procedures. However, delays in developing an operating plan acceptable to the U.S. Fish and Wildlife Service and concerned property owners located in unprotected portions of the floodplain precluded determination of effects in Manitoba. With assurance of agreement on the operating plan for the more frequent lesser floods by concerned interests in the United States, the Burlington Dam Task Force was recently reactivated. However, the Board adopted the position that the current directive to the Board does not extend to evaluation of benefits and costs of possible flooding mitigation measures in Manitoba or to a determination of the liability of the Corps for expected flow increases during storage drawdown periods.

9.13 In October 1977 the Task Force completed its studies based on the current directive and issued a report outlining its findings to the Board. The Task Force reported that storage above Burlington Dam would have little, if any, effect on Saskatchewan and that the impacts of the project on Souris River flows in Manitoba would be minor. The Board concurred with the findings, noted that the economic and environmental effects of flow changes in Manitoba had not been evaluated, and submitted the report to the Commission where it is currently under review. (See letter, appendix D of the Phase I GDM.)

9.14 Prior to completion of the Task Force report, the Board adopted the position that the current directive to the Board did not extend to evaluation of economic or environmental effects of the Burlington project on Canada or costs of possible mitigation measures in Manitoba, if required. Subsequently, upon request by the Commission, Governments formally authorized the expansion of the scope of work assigned to the Souris-Red Board to include an economic and environmental evaluation of the anticipated effects in Canada of the Burlington Dam and possible mitigating measures. (See letter, appendix D of the Phase I GDM.)

9.15 In its letter transmitting the Task Force report to the Commission, the Board concluded that planning for the project could proceed concurrently with the studies of mitigation measures and impacts. However, with reference to construction, the Board noted that it could only advise the Commission on the impacts in one country of a project in the other as presented in the Task Force report. The most recent action by the Commission is that it has requested the Board to prepare a plan of study outlining procedures to investigate the economic and environmental impacts of the project in Canada and to consider a range of alternative mitigation measures. The Commission is expected to formally charge the Board with the expanded studies in the near future and, based on current information, the Task Force estimates that its studies will require about 6 months to complete.

Cultural Resources Coordination

9.16 In the earlier Final Updated Environmental Impact Statement (January 1975) are included letters of correspondence pertinent to cultural resources from Roy Reeves of the National Park Service (4 March 1974 and 12 February 1974) and two letters to Nick Franke, Research Archaeologist with the State Historical Society of North Dakota (12 March 1974 and 20 May 1974) regarding our initial field reconnaissance. These letters are no longer current so were not included in the draft or this final environmental impact statement. The draft environmental impact statement was provided to the cultural resources review agencies. The Denver Office of the Advisory Council on Historic Preservation (16 November 1977 and 12 December 1977), the Department of the Interior (12 December 1977), the Environmental Protection Agency (27 December 1977) and the State Historical Society of North Dakota (6 December 1977) comments regarding cultural resources have been included with responses. A letter of comment from the University of North Dakota Department of Anthropology and Archaeology is anticipated, but was not received prior to printing of this document. This letter and all future correspondence will be considered in future documents.

Review Of The Drafts EIS

9.17 The draft EIS has been reviewed by Federal and State agencies, local units of government and concerned citizens. The comments received and the Corps responses are contained in the comment/response section of this final EIS.

9.18 Numerous letter of opposition to the project were received from rural interests that may be affected by the mitigation plan. (The mitigation is a part of the proposed flood control plan and not a separate plan.) These same interests have voiced unanimous support for the environmental quality plan. Because of the opposition to the mitigation plan, a letter of clarification was sent to the Corps by the U.S. Fish and Wildlife Service (see letter dated 9 December 1977, Exhibit 5 in the final EIS). All comments received concerning the draft EIS are contained in the comment/response section of this final EIS.

9.19 Copies of the draft environmental impact statement were sent to the following known interests for review and comment:

U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
U.S. Department of Transportation
The Advisory Council on Historic Preservation

North Dakota Department of Agriculture and Labor
North Dakota Forest Service
North Dakota Geological Survey
North Dakota Game and Fish Department
North Dakota Department of Health
North Dakota Department of Highways
North Dakota Historical Society
North Dakota State Archeologist
North Dakota State Historic Preservation Officer
North Dakota State Outdoor Recreation Agency
North Dakota Planning Agency
North Dakota State Soil Conservation Commission
North Dakota Water Commission
The Honorable Arthur A. Link, Governor of North Dakota

Ducks Unlimited
Izaak Walton League
North Dakota Water Users Association
North Dakota Wildlife Federation
Sierra Club
Town and Country Sportsman's Club
Wildlife Management Institute
The Wildlife Society

Bottineau County Board of Commissioners
Bottineau County Water Management Board
City of Burlington
Garrison Diversion Conservancy District
McHenry County Board of Commissioners
McHenry County Water Management Board
Minot City Planning Board
Minot Park Board
Renville County Board of Commissioners
Renville County Water Management Board
City of Sawyer
Souris-Red-Rainy River Basin Commission
Souris River Flood Control Planning Commission
City of Velva
City of Towner
Ward County Board of Commissioners
Ward County Water Management Board

9.20 Copies of the draft statement were also furnished to the following libraries, where they were held as reference material available to the general public for review:

University of North Dakota Library
ATTN: Documents Librarian
Grand Forks, North Dakota 58201

Veterans Memorial Library
520 Avenue A East
Bismarck, North Dakota 58501

North Dakota State University Library
ATTN: Documents Librarian
Fargo, North Dakota 58102

Minot State College Library
Minot State College
Minot, North Dakota 58701

Minot Public Library
516 Second Avenue Southwest
Minot, North Dakota 58701

9.21 Comments on the draft statement were received from the following:

U.S. Environmental Protection Agency
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Health, Education, and Welfare
U.S. Department of Commerce, National Oceanic and Atmospheric Administration
U.S. Department of the Interior
Bureau of Outdoor Recreation

U.S. Department of Housing and Urban Development
Federal Insurance Administration
Federal Energy Regulatory Commission
U.S. Department of Transportion
Advisory Council on Historic

North Dakota Fish and Game Department
North Dakota State Department of Health
North Dakota Geological Survey
North Dakota State Geologist
North Dakota State Historical Society
North Dakota State Outdoor Recreation Agency
North Dakota State Water Commission

City of Minot
Renville County Board of Commissioners

Mrs. Erma Aalund
Mark and Julie Adams
Richard J. Backes, North Dakota State Representative
Donald Boll
Raymond Boll
Bottineau Chamber of Commerce
Clifford Burbidge
Leland Burtness
L.J. Buzzell
Carpio Public School District

Dennis T. Disrud
Walter Erdman, North Dakota State Senator
Ora Fischer
Mr. and Mrs. Harry Flaherty, and James
Norwin L. Fylling
Michael Gates
Mr. and Mrs. Reuben Gravseth
M. Byron Grubb

Conrad Haarsager
Orlin M. Hanson, Co-Chairman, Citizens United to Save the Valleys
Bruce Helseth
Larry Herslip, North Dakota State Representative
L. Wilbur and Lois L. Johnson
Nora Johnson
Palmo Johnson
Mrs. Richard Johnson
Mr. and Mrs. Dale Keith
C.R. Keller
Laverne C. Kreft
Anna L. Krenz
Paul Krenz, President, McKinney Cemetery Association

Mr. and Mrs. C.L. O'Keeffe
Mr. and Mrs. Harry Ostlund
Mrs. Jack Miller
Mrs. Laurence Nelson
Melvin H. and Vera L. Nelson
Kenneth Niewoehner

James Reinarts
Clarence E. Sauer, Superintendent, Granville Public School District
Lynn Schepp
Billy Siercks
Mr. and Mrs. Clair O. Southam
Henry and Mary Stammen
Embert Sveum
Donald Streitz

Dale Thorenson
Peggy Thorenson
Leo and Janice Volk
Mr. and Mrs. Willie Williams

9.22 The comments received, along with Corps responses, can be found on the following pages.

LETTERS of COMMENT and CORPS RESPONSES

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DENVER, COLORADO

DEC 2 7 1977

Ref: 8W-EE

Colonel F.T. Gay, III
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Customs House
St. Paul, Minnesota 55101

Dear Colonel Gay:

We have reviewed the Draft Environmental Impact Statement ... Design Memorandum No. 2, and Supplement No. 1 to Design Memorandum ... Burlington Dam, North Dakota. Most of our comments concern ... though occasional references are made to the other documents that were submitted for review.

In general, we believe that the draft EIS does a creditable job of describing the very severe environmental impacts that could result from implementing the proposed action. There are, however, some areas of the impact analysis which we believe should be improved. These areas include the discussion of water quality in relation to the project, the analysis of alternatives, and timely procedural compliance with the National Environmental Policy Act (NEPA).

1. We believe that the discussion of water quality contained in the draft EIS is too abbreviated to provide readers of the document with sufficient information about existing water quality or potential impacts of the project on water quality. In future versions of the EIS, we suggest that some attempt be made to include more long term water quality monitoring data from the study area and any relevant information on long-term water quality trends. Although the selection of two days water quality data as shown in Table 2 of the EIS may be useful in illustrating the dependency of water quality on stream flows, we believe that a clearer picture of water quality in the Souris River would emerge from displays of yearly average figures for the various parameters based on several years of data (which may be accompanied by selected days data for illustrative purposes), or by an attempt to correlate long term water quality data directly with stream flows. In any case, we believe that more of the existing water quality data from the Souris River should be used. Furthermore, we noted that Supplement No. 1 to Design Memorandum No. 1 contains some water quality information that should also be discussed in the EIS. For example, a summary of the supplement's discussion of biological oxygen demand and nutrient releases caused by decomposition of vegetation under water should be included in the Draft EIS. The data ...

Corps Responses to Comments Made by the U.S. Environmental Protection Agency

1. We concur with the comments on water quality. The discussion of water quality has been expanded in the final EIS to include data from the Supplement to Design Memorandum No. 1 and also to include other data as best as can be determined at this time. Further studies are programmed to further determine the environmental effects of the project and appropriate mitigation measures.

nutrient composition would also be more useful if carbon and nitrogen were included among the parameters shown.

2. While the draft EIS acknowledges that precise predictions of the project's water quality impacts are difficult, if not impossible to make, we recommend that more work be done in attempting to hypothesize what the impacts of operating Burlington Dam would be. Such an effort should begin with a discussion of any data that may be available on the water quality impacts of operating dry flood control reservoirs elsewhere. Even though these data would probably not be directly applicable to the situation at the proposed project, they may provide some indication of changes in water quality that can occur as a result of storing floodwaters in a dry dam and gradually releasing them. Another approach to the problem of evaluating the effects of operating Burlington Dam would be to pose the question to limnologists and ecologists who may be able to draw some conclusions from the total amount of vegetation that would be inundated, the volume of water, the composition of some of the plant materials involved, the length of time that water would be stored in a given situation, etc. Finally, we believe that it is very important that the EIS recognize that the water quality impacts of the proposed action are in fact uncertain, and that the EIS discussion of these possible impacts is merely the best estimate that can be made as to the actual effects of storing floodwaters behind Burlington Dam.

3. We strongly recommend that your agency implement a comprehensive water quality and ecological monitoring program if the project is built and used to store flood waters. The data from such a program could be useful in predicting the effects of the dry dam flood control projects that may be proposed in the future.

4. In regard to mitigation of the water quality impacts of the proposed actions, we have two concerns. First, we believe that a comprehensive vegetation rehabilitation program must be included as a part of the project plans and operational budget. Although we recognize that there are many uncertainties about the details of the degree to which the terrestrial vegetation of the flood control pool will be disrupted if flood storage is necessary, there is little doubt that extensive die-off of the plants that protect soils from erosion could result in severe ecological changes. Some of these (e.g. weed problems and other changes in vegetation following flood water storage) have been addressed in the draft EIS. However, we fear that the significance of the vegetation at the site and its usefulness in preventing soil erosion has not been fully appreciated.

5. Studies of experimental watersheds have demonstrated that runoff, sedimentation, and total releases of nutrients increase dramatically when vegetative cover is killed, even if it is left in place and there is little direct soil disturbance. With as much as 25,000 acres

Corps Responses to Comments Made by the U.S. Environmental Protection Agency (Continued)

2. Several highly fluctuating reservoirs and dry dams were investigated in the planning phase of the project in arriving at the conclusions drawn in the EIS. However, we will further investigate impacts of dry dams in future design studies.

   The professional judgement of ecologists, foresters, and limnologists has been employed in projecting the impacts of temporarily storing water behind the proposed Burlington Dam. The fact that the water quality impacts of storing water behind the Burlington Dam is only the best estimate (based on professional judgement) is acknowledged in the final EIS.

3. We will consider such a program in future, more detailed studies.

4. Although the operation and maintenance estimate includes costs for weed control and reforestation, these estimates will be further refined when a vegetation rehabilitation program is defined in later studies.

5. Concur, see the two preceding responses.

inundated at full pool, we believe that there is great potential for very serious soil erosion and water quality problems resulting from extensive loss of live vegetative cover, release of nutrients through breakdown of vegetative debris, and subsequent erosion of soil by winds and runoff. In view of this, we believe that a vegetation rehabilitation plan must be prepared and ready for implementation immediately upon storage and release of floodwaters. We believe that the plan should reflect the thoughtful consideration of agronomists, terrestrial ecologists, wildlife biologists, hydrologists and soil scientists in order to assure that a stable and diverse ecosystem is restored to the area as quickly as possible after the existing ecosystem has been destroyed by floodwaters.

6. A second area of concern regarding mitigation of water quality impacts is related to construction of the project. The documents submitted for review do not address the methods by which excavated soils will be protected from erosion. This concern is especially pertinent in regard to the Des Lacs diversion tunnel and the downstream local protection measures. However, all disturbed soils, including those that that are stockpiled for later use, should be managed carefully in order to minimize wind and water erosion.

7. As a result of our review of the documents on the proposed action, we have a number of concerns about the analysis and selection of alternatives. We are sensitive to the pressing need to find solutions to the flood damage problems that occur along the Souris River. We also realize that all federal agencies, including the Corps of Engineers, share in the responsibility to balance human and environmental needs or, in the words of NEPA, to "encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the biosphere and stimulate the health and welfare of men..." This charge was recently amplified by the President in his Executive Order on Floodplain Management (EO 11988), which seeks to "avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development whenever there is a practicable alternative..."

We do not believe that the proposed action complies with the spirit and intent of either NEPA or the Executive Order. Construction and operation of the project would merely transfer flooding from developed areas to areas where relatively few improvements that are susceptible to flood damages have been made. We believe that this action unjustly penalizes the people who have not invested heavily in developing a flood prone area because now they must face a greater degree of flooding in order to relieve the flood damage problems encountered by downstream inhabitants who developed the floodplain. We also question the appropriateness of claiming a "location benefit", or economic benefits arising from future development of the floodplain once flood protection has been provided.

Corps Responses to Comments Made by the U.S. Environmental Protection Agency (Continued)

6. Concur. It is normal policy to topsoil and seed areas of disturbed soils at all construction sites. Since the project area may be more susceptible than normal to wind and water erosion, special measures may be necessary to prevent erosion of even temporarily stockpiled materials.

7. The rationale for use of location benefits is provided in the Phase I General Design Memorandum, Appendix C.

Assigning these benefits to any structural flood control measure appears to be in direct conflict with the intent of the Executive Order cited previously and gives such proposals an unfair advantage over non-structural solutions to flood damage problems in most economic comparisons.

8.

*We believe that the Water Resources Council acted wisely in develop*ing the Principles and Standards or Water Resources Planning. The emphasis of the Environmental Quality Account and the Environmental Quality Plan under the Principles and Standards follows logically from the National Environmental Policy Act and supports the intentions of the President's environmental message of May 23, 1977. We believe that this aspect of the Principles and Standards is extremely important in regard to the proposed project because the proposed environmental quality (EQ) plan would balance the need to provide a satisfactory degree of flood protection to the citizens of Minot with the need to protect the unique resources of the Souris Valley from the severe impacts of building and operating the major flood control reservoir. The EQ plan would also largely confine the impacts of flood control measures to areas that have already been disturbed and avoid many of the impacts to relatively undisturbed lands. We do not believe that the unfavorable benefit-cost ratio of the EQ plan that was studied should automatically preclude it from consideration. Many of the environmental benefits of such a plan are not readily quantifiable in an economic analysis and therefore, it is not surprising that EQ plans are less economically attractive than those based solely on economics. Indeed, the whole purpose of requiring an EQ plan and account under the Principles and Standards is to encourage consideration of alternatives that are more harmonious with the environment even though the benefits of doing so may be difficult to quantify in economic terms. The Principles and Standards do not rule out selection of an EQ alternative solely on the basis of its economic feasibility. In fact, the Principles and Standards state that "a plan with a less than unity benefit-cost balance may be recommended as long as the net deficit does not exceed the benefits foregone and the additional costs incurred for the environmental quality objective (38 FR page 24832, September 10, 1973)." We urge you to recognize this in your revisions of the draft EIS so that readers of the document realize that the EQ plan is a reasonable means of balancing flood control and environmental protection.

In view of the differences between the authorized project and the proposed plan (as tabulated on pages 88-93 of Design Memorandum No. 2), we believe that congressional reauthorization of the project is likely to be required. We also believe that the wildlife resources and natural ecosystems of the study area warrant special consideration in the selection of alternatives. Specifically, we believe that an EQ plan designed to *protect these resources while reducing flood damages may be justifiable if* examined from more than just an economic perspective. Thus, we urge you

Corps Responses to Comments Made by the U.S. Environmental Protection Agency (Continued)

8. We admit that the recommended plan will cause severe environmental impacts. However, it is our view that of all the alternatives analyzed, the selected plan would provide the best balance between economic, environmental and social considerations as specified in the Principles and Standards. Philosophically, local protection plans at Minot are highly advantageous in that the adverse effects would accrue in the area benefited and not in areas receiving no benefits. However, local protection plans such as the EQ plan or a levee-floodway plan cannot be implemented within the Corp's current policies and regulations unless some way could be found to circumvent the economic and social problems of such plans, i.e., the lack of overall economic feasibility, the high local costs, the low degree of protection and the high dislocation involved. Another factor to consider is that construction now of a project providing a low degree of protection may foreclose future options to provide further protection if found necessary since a large portion of the economic benefits (presently available) would no longer be available. In our view, these problems are reasonably avoided with the selected plan.

to continue to refine the EQ plan and submit it to Congress for examination as an alternative to the proposed action. We believe that the documents sent to Congress must present the lawmakers and the public with an EQ plan that they can choose as an alternative to the severe environmental impacts of the recommended plan.

9. A third area of concern to us is a statement on page 16 of the draft EIS which indicates that you do not consider it necessary to impose a requirement to prohibit future development in the floodplain. Any flood control project which is eventually built in the Minot area will define a new floodplain. It makes no sense to expend federal tax dollars to provide flood protection, and then permit future development to locate in the newly-defined floodplain area. This creates a vicious circle which could result in the need for another federal flood control project at some future date. We recommend that it be a mandatory requirement that local governments adopt appropriate ordinances to prohibit development within the new floodplain resulting from flood control measures. You should require adoption of such ordinances before you commence construction.

10. Finally, the draft EIS refers to archaeological and historical investigations that are not as yet completed. We are concerned about this for two reasons. First, decision-makers and the public have not been afforded the opportunity in the draft EIS to identify these cu[illegible] resources and to determine how they would be affected by the pr[illegible] action. If these investigations are completed at a later date, we doubt [illegible] they will receive the same widespread review that they would receive under NEPA through their inclusion in the draft EIS. Thus, an important legal requirement of the NEPA review process is incomplete. Our second concern is the fact that information on cultural resources should be an important part of the data that are used by the Corps of Engineers in the planning and design of any project. EPA views the EIS process as a planning/decision-making tool that is designed to bring consideration of environmental impacts into the formulation of proposals rather than an after-the-fact analysis of the impacts of the selected plan. In planning projects such as these we urge you to become familiar with environmental and cultural base-line conditions earlier in the process so that information on those conditions can be more fully considered in the planning/decision-making process and the resources and the impacts of a proposal in these resources can be displayed for public review in the draft EIS.

In summary, we are concerned about the environmental impacts of the proposed project, particularly as they relate to water quality and general degradation of ecological resources in the study area. We would greatly prefer implementation of a solution to flood damages in the Souris valley that would not entail such severe environmental impacts, and we urge you to give Congress an opportunity to consider the environmental benefits that can be gained from implementing an Environmental Quality plan alternative.

Corps Responses to Comments Made by the U.S. Environmental Protection Agency (Continued)

9. We agree that local governments should adopt appropriate ordinances to prohibit development within the new floodplain resulting from flood control measures. However, to make this a mandatory requirement is beyond the authority of the Federal Government. Such authority rests with the State and local units of government. Nevertheless, in the absence of a State floodplain regulation the project recommendation does include as one item of local cooperation the requirement that local interests "provide guidance and leadership in preventing unwise future development of the floodplain by use of appropriate floodplain management techniques to reduce flood losses from the Burlington damsite downstream to the New Prairie-Sundre Township line near Logan." Although not included as a specific item of local cooperation we will continue to encourage local units of government in the Logan to J. Clark Salyer Refuge reach of the Souris River to adopt floodplain regulations.

10. These concerns are addressed in paragraphs 2.173 to 2.179 of the final EIS.

Because of the concerns outlined above, we have rated the draft EIS for Burlington Dam ER-2. This rating signifies EPA's serious reservations about the proposed project and deficiencies in information or analysis of environmental impacts.

I greatly appreciate the cooperation that your staff has shown during EPA's review of the Burling Dam EIS and I look forward to your careful consideration of our environmental concerns. Please do not hesitate to contact this office if you have any questions regarding our views.

Sincerely yours,

Alan Merson
Regional Administrator

AD-A120 211 CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT F/G 13/2
BURLINGTON DAM, SOURIS RIVER, NORTH DAKOTA, FLOOD CONTROL. FINA--ETC(U)
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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Box 1458, Bismarck, ND 58501

December 2, 1977

Mr. Forrest T. Gay, III
Colonel, Corps of Engineers
Department of the Army
St. Paul District, Corps of Engineers
1135 U. S. Post Office & Custom House
St. Paul, MN 55101

Dear Colonel Gay:

We have reviewed the draft Environmental Impact Statement dated October 1977, for the Flood Control of Burlington Dam, Souris River, North Dakota document transmitted with your letter of October 25, 1977.

The proposed project will not affect project actions of the Soil Conservation Service within the project area. We note that the proposed project impacts on the agricultural industry and agricultural lands in the area are discussed and displayed.

We have no further comments on the draft Environmental Impact Statement for the Flood Control of Burlington Dam on the Souris River, North Dakota.

Charles F. [illegible]
Allen L. Fisk
State Conservationist

cc: SCS, Environmental Services Division, Washington, DC

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE CENTRAL REGION
Room 1836
601 East 12th Street
Kansas City, Missouri 64106

December 16, 1977

WFC2x1

COL Forest T. Gay III
District Engineer
St. Paul District Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Reference: NCSED-PB letter dated Oct 25, 1977
1. Draft Environmental Impact Statement for the Burlington Dam, ND
2. Design Memorandum No. 2 for Burlington Dam, ND

Dear COL Gay.

We have reviewed the referenced drafts and submit the following corrections and clarifications:

Reference 1, pages 114-115, "Flood Warning and Forecasting Services and Emergency Protection".

1. Paragraph 6.15 credits the National Weather Service Office in Fargo with the basic data exchange with Canada. This is true for the Red River of the North, but the Souris Basin responsibility rests with the National Weather Service Forecast Office at Bismarck.

The inaccuracy of paragraph 6.16 is disturbing. It appears the author was not aware that standard long range spring flood outlook and shorter range flood forecast systems for the U.S. portion of the Souris had been devised by the National Weather Service following the 1969 flood. Since then it has received river forecast service identical to that provided for many years for the Red and Mississippi Rivers and other streams in the upper Midwest.

2. By the fall of 1974 forecasting procedures were extended to the Canadian Souris in cooperation with Canadian officials in Regina. This included strengthening of reporting networks on both sides of the border including telemetry and Gamma radiation flights to measure water content of snow. Long range outlooks and short range forecasts have been coordinated with Corps of Engineers, Fish and Wildlife Service and the Canadian Department of the Environment every year since 1969. Spring snowmelt flood outlooks as well as post-flood reviews have been presented to the International Boundary Commission.

Corps Responses to U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Comment

1. The cited sentence has been corrected in the final EIS.

2. This information has been included in the discussion of flood warning and forecasting services and Emergency Protection in section 6 of the final EIS.

Procedures were developed and operational forecasts services are provided by the Kansas City River Forecast Center, with outlooks and forecasts issued from the Bismarck office. Advance NWS advisories prior to the 1975 and 1976 floods contributed to the success of the emergency levee construction and flood fights expressed in paragraph 6.17.

The need for improved data collection has been recognized. Telephone telemetry river gage equipment has been installed on the Des Lacs River at Foxholm, the Souris River near Foxholm, Minot and near Westhope, the Deep River near Upham. Radio telemetry river gage equipment has been installed on Longs Creek near Noonan and at Western Crossing.

Reference 2, Appendix B, page 33.

We propose that Item b. should read:

The limitations of an adequate flood forecasting procedure to provide crest lead times sufficient for emergency levee construction for flood rises produced by heavy upstream rainfall.

3. Experience during the past few years indicates the warning and forecast service is far from "inadequate" as stated in 6.16 or "inaccurate" as stated in this section. In fact, the National Weather Service was publically commended in May 1976 for the valuable contribution of its flood forecasting service related to the emergency flood prevention measures undertaken by the Corps of Engineers for the City of Minot.

In regard to short-fused flash flood warnings, the area of interest is served by the Bismarck office. Flash floods are usually produced by very heavy, high intensity thunderstorm rainfall in four hours or less putting such warnings in the category of life saving, with little time available for the protection of property. They are not events which provide the time needed for emergency levee construction, but are more appropriate to flood plain zoning and flash flood alarm systems. We have asked our Bismarck office to investigate the need for a flash flood program for Gassman Coulee.

This is a preliminary response because of our concern with the draft EIS and to comply with your deadline. We are forwarding this to you for your consideration; however, we are also relaying this information to the Department of Commerce who will submit the final comments.

Sincerely,

Robert E. Baskin (for)
Charles G. Knudsen
Director, Central Region

Corps Responses to U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Comments

3. Comments made on the draft Phase I General Design Memorandum are addressed in that document.

DEPARTMENT OF HEALTH EDUCATION AND WELFARE

December 9, 1977

Forrest T. Gay, III
Colonel, Corps of Engineers
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Thank you for the opportunity to review the draft environmental impact statement for Flood Control, Burlington Dam in the Souris River Basin, North Dakota.

It appears that the impacts expected to result from this proposed project and reasonable alternatives thereto have been adequately addressed.

Sincerely yours,

Wellington E. Webb
Principal Regional Official

cc:
Office of Environmental Affairs
HEW, Washington, DC (1 copy)

Council of Environmental Quality
Washington, DC (2 copies)

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION
REGIONAL OFFICE
TITLE BUILDING, 909 17th STREET
DENVER, COLORADO 80202

REGION VIII

December 13, 1977

81 Olson

District Engineer
Department of the Army
St. Paul District, Corps of Engineers
St. Paul, Minnesota 55102

Dear Sir:

The following comments were prepared in response to the draft Environmental Impact Statement on the Burlington Dam, Souris River, North Dakota dated October, 1977. Please consider their substance carefully.

The narrative outlining the non-structural, no action, alternative to the Burlington Dam Flood Control project as presented in the Environmental Impact Statement does not present an adequate analysis of the non-structural approach.

Though the non-structural alternative is named the no-action approach, since it involves no action by the U.S. Army Corps of Engineers, it does, however, represent positive actions by both the public and private sectors to mitigate losses associated with flood hazards. The Burlington Dam EIS severely understates the case supporting the non-structural approach. If the EIS is to accurately access the impacts and establish justification for the project, the following considerations must be made.

1. Several incomplete statements are made regarding the National Flood Insurance. First, Section 6.08 erroneously implies that flood insurance is available only for existing structures when protected to the 100-year flood elevation. The only structures that are required to be protected to the 100-year flood level are those newly constructed or substantially reconstructed after the date that base flood elevations were supplied to the community.

Those structures built prior to the date that the base flood elevations were provided may receive Federally subsidized flood insurance without being protected to the 100-year flood elevation. New structures built after the determination of base flood elevations are eligible only for actual Flood Insurance Rates, i.e. the risk of flooding relative to the elevation of the structure. Therefore, the cost of protecting all existing structures in the

Corps Responses to HUD (Federal Insurance Administration)
Comments

1. Appropriate revisions to the final EIS have been made. See paragraphs 6.08 and 6.09 of the final EIS.

flood hazard area by floodproofing measures to the 100-year flood elevation should not be considered a cost of the no-action approac Given that elevation of previous existing structures is not necessary to receive insurance benefits, this should not be considered as a benefit of the Burlington Dam.

2. Second, Section 6.07 states that in the long term, flood plain regulations and flood insurance reduce non-conforming uses and promote evacuation in some cases. *A complete statement regarding these programs however*, should relate that in the long term that the non-structural approach will provide as much protection from losses due to floods as a flood control project, thereby making a structural project unnecessary. Therefore, protecting property from damage of a base flood should not be considered a long-term benefit of the Burlington Dam, since the result of both alternatives will be no loss by the 100-year flood.

3. *Third*, the statement is not made that a flood control project can provide protection only to its designed capabilities, whereas, flood insurance will pay claims regardless of *the size of the flood*. Since flood control projects create a false sense of security among the residents of flood-prone areas regarding the exact hazards, people are reluctant to renew their flood insurance. *Therefore*, a cost of the Burlington Dam is the loss of protection that would result from either a breached dam or flood which exceeds the design capacity of the dam.

4. Fourth, and probably most important to *a proper cost-benefit analysis*, are the public and private cost benefits of the Burlington Dam project. The only benefits that should be credited to the Burlington Dam are those which the project actually creates. For example, it was previously demonstrated that long term protection to the 100-year flood elevation is not a long term benefit created by the flood control project, since the same benefit is being created by flood plain management. Also, the *real* benefit of being able to develop property previously identified as flood *hazardous* is not the value of the new real estate brought into production, but the difference of the benefits derived by developing flood-prone vs. non-flood-prone areas. There are alternative sites for *new development* available outside of the existing flood plain.

5. Lastly, the accuracy of the statement in Section 6.09 that the public not residing in the flood plain would experience the smallest adverse social and economic impacts with the no-action plan is to be applauded.

Both the Congress of the *United States in establishing the National* Flood Insurance Program and the President in recent Executive Order 11988, established strong National *public policy statements* in support of non-structural flood plain management. The Burlington Dam EIS will remain deficient until it can satisfactorily demonstrate that the benefits of *the Burlington Dam* exceed benefits of these public policies.

2. In the economic analysis, Design Memorandum No. 2, Phase I, plan formulation, damages are annualized on a frequency basis. The principal reason for computing average annual damage is to *determine* the effectiveness of different *structural* and non-structural plans in reducing damage. This reduction is commonly referred to as an inundation reduction benefit and is meas[illegible] as the difference in equivalent annual flood damage with and [illegible]ut a plan. In formulating plans to meet the national economic development *(NED) and* environmental quality (EQ) objectives, an array of alternative plans is developed to present several options for consideration prior to making a final decision. The *significant advantages* of the evacuation alternative are that flood damages would be nearly eliminated in 8 to 10 years, without disturbing the existing river system, and former *ecosystems*, which existed before urbanization, could again return. The principal advantage of the Burlington reservoir and related works is the *elimination* of recurring *economic* losses. The Burlington Dam meets the economic efficiency criteria of positive net benefits and evacuation is not generally socially acceptable to the people in the Minot floodplain.

The St. Paul District concurs with the FIA statement "that in the long term that the non-structural approach will provide as much protection from losses due to floods as a flood control project." However, the economic advantages of flood control at Minot, North Dakota, are shown to exceed the advantage of *waiting* for the economic decline of existing development in the floodplain. It is not sufficient to allow damage, destruction, and misery to continue, even if physical property damage is recouped through insurance transfer payments over time. The economic consequences of [illegible]et protecting insure that the national account will suffer the average annual losses indicated in the report. Only the burden of these flood damage losses is shifted. While full support must be given to non-structural measures, one must not [illegible]se sight of the extremely slow reduction that these programs effect in floodplains already extensively developed. Structural protection is intended to supplant the need for flood insurance in the Minot, North Dakota, floodplain. This is to the net benefit of the nation as well as local floodplain users. However, the selected plan includes non-structural measures including floodproofing and evacuation in sparsely *developed* rural areas where structural measures are infeasible. The selected plan also includes continuance of floodplain regulations to apply to the modified 100-year *floodplain*, particularly in the Minot area where the potential for growth is greatest.

Corps Responses to HUD (Federal Insurance Administration)
Comments (Continued)

3. The Burlington Dam and related works provide about 240 years combined degree of protection at Minot from all sources. However, the dam provides about 80 percent Standard Project Flood (SPF) from the upper Souris River, the source of the largest flood damages at Minot. The Burlington Dam is designed for maximum protection within the limits of the United States storage capacity on the upper Souris River.

   In practice, flood insurance policies at Minot appear to be purchased mainly by interested residents in the 100-year floodplain even though flood insurance is available at higher elevations.

   Flood control benefits are calculated on the basis of flood damage reduction. Average annual benefits for the Burlington Dam and related works represent about 93 percent of the total average annual urban and rural Souris River flood damages, including frequent and infrequent floods.

4. Floodplain management measures, such as flood insurance, are alternative methods of providing flood protection for urban areas. Regulations require that all projects be evaluated according to the National Economic Development (NED) plan and the Environmental Quality Plan (EQ). Economic considerations include benefit-cost ratios, net benefits (excess benefits over costs) and percent reduction in average annual damages for each plan. Intangible benefits would include the loss of life and the inconvenience of temporary evacuations during floods and the cleanup after floods.

   While it is recognized that alternative floodplain sites are available for development, the alternative sites are not as aesthetically and climatologically desirable. The amenities of the Souris River with its trees and water are very attractive for residential purposes.

5. Comment noted. No response necessary.

Page 3

6. In paragraph 6.22, page 116, flood plain evacuation was considered as an alternative. Some level of flood plain evacuation might result in a positive benefit-cost ratio but evacuation of the entire 100-year flood plain resulted in a benefit-cost ratio of .6? Various alternative evacuation plans should be considered such as only removing structures that will experience the greatest damage from flooding, evacuation of entire 20-year, 30-year, 50-year flood plain, etc.

7. In paragraph 6.03, page 111, it was stated that one of the basic criteria used in reaffirming or reformulating the Burlington Dam alternatives was that a maximum practical degree of flood protection should be provided to Minot and other susceptible areas. While the recommended plan has a benefit-cost ratio of 1.39, neither the Draft Environmental Impact Statement nor the Design Memorandum No. 2, Phase I - Plan Formulation indicates the incremental benefits (from reduced flooded area and water surface elevation) associated with the incremental costs of various portions of the recommended plan. The proposed project includes: 1) Dam near Burlington, 2) Raise of Lake Darling Dam, 3) Tunnel to carry Des Lacs flood flows to the Souris River above Burlington Dam, and 4) Levee upgrading between Burlington and Minot and at Sawyer and Velva. There is the possibility that only a portion of the above four facilities should be built based upon benefit-cost analysis. As an example, the dam near Burlington by itself has a benefit-cost ratio of 1.62. The analysis of the other three facilities should have then been separately evaluated assuming as a base condition that the Burlington Dam was in place. Using this correct method of analyzing the project, it might have been determined that the construction of the other facilities would result in benefit-cost ratios of less than one. By evaluating all four facilities together, it is very possible that some uneconomic facilities have been included.

8. On October 20, 1977, I sent a letter to you concerning the depth-damage data being used in the Minot vicinity. Please refer to that letter for details. Briefly, it stated that the depth-damage curves being used by the St. Paul District result in significantly greater damages to structures than those obtained by using Federal Insurance Administration depth-damage curves issued in 1975. We believe the FIA curves to be very accurate but may still over estimate damage to a small degree. The FIA curves are based upon thousands of paid flood insurance claims. One item not mentioned in the October 20, 1977 letter was that on page 9 of the Minot and Vicinity Flood Insurance Study, February, 1970, done for the FIA, depth-damage data is presented. Its use again results in significantly greater damages than the FIA curves. By overstating or misrepresenting damages, uneconomic projects may result.

9. On page C-1 of the Design Memorandum, it was stated that an interest rate of 5 1/8 percent was used in the project evaluation. An informational memorandum received in this office from Leo M. Eisel, Director of the Water Resources

Corps Responses to [illegible] (Federal [illegible])
[illegible]

6. A [illegible]-year flood would [illegible] Lake Darling Dam and the modified [illegible] Minot. A [illegible]0-year flood corresponding to a peak flow of [illegible] would be controlled within the freeboard range of the channel [illegible] in Minot. A 50-year flood corresponds to a peak flow of [illegible] or [illegible],000 cfs in excess of channel capacity in Minot [illegible] amount of overbank flow corresponds to the amount of overbank [illegible] that occurred in 1969 in Minot when a peak flow of [illegible] exceeded a channel capacity of 2,000 cfs existing at that time. [illegible] 1969 the Souris River flooded an estimated 3,000 residences and [illegible] businesses and forced evacuation of 12,000 Minot residents. Accordingly, evacuation of the 50-year floodplain does not appear any more feasible than evacuation of the 100-year floodplain which would require the removal of about 3,600 residences and 300 businesses and dislocation of about [illegible] Minot residents. The problem is the flatness of the floodplain. Any appreciable amount of flow in excess of channel capacity immediately affects several hundred developments. For this reason, the feasibility of partially evacuating any intermediary floodplain between the 30-year and 50-year floodplains is doubtful. Evacuation plans, either partial or complete, are as economically infeasible from a local standpoint as from a national one, due to high non-Federal cost and/or social adverse impacts in view of the vast number of developments involved. Another factor to consider is that flood benefit analyses are frequency related. To implement a plan now providing a low degree of protection, e.g., partial evacuation, may foreclose the opportunity to implement further measures in the future, if needed, since a plan providing a low degree of protection would capture a major portion of the available economic benefits.

7. Design Memorandum No. 2 provides a discussion on the incremental feasibility of the four facilities cited in the comment. The National Economic Development (NED) plan or most economic plan is defined as one involving a 22-foot raise of existing Lake Darling Dam and levees in 3 of 9 urban areas between Burlington and Minot and at the community of Velva. All other features included in the selected plan are incrementally uneconomic. However, in view of the potential of extreme, rare floods causing loss of life and property, the selected plan was developed to provide maximum protection within reasonable economic, environmental and social limitations. Accordingly, the Lake Darling damsite was dismissed in favor of the downstream Burlington damsite because of its greater storage potential and control over extreme Des Lacs River floods. Levees were added in all flood prone urban areas outside of Minot including 4 additional urban areas between Burlington and Minot and at Sawyer to accommodate the proposed maximum reservoir release rate of 5,000 cfs which was

Page 4

Council dated November 3, 1977, stated that the interest rate to be used by Federal agencies in the formulaton and evaluation of plans for water and related land resources is 6 5/8 percent for the period October 1, 1977 through and including September 30, 1978. The difference of 1 1/2 percent can make a major difference when the costs and benefits are capitalized. The effect of the higher interest rate is to reduce the benefit-cost ratio because the majority of the costs occur during project construction whereas the benefits occur throughout the life of the project. The higher interest rate reduces the benefits which occur in the future.

Sincerely,

Jerome M. Olson
Regional Director
Federal Insurance Administration

cc: Walter O. Kelm, Env. Qual. Div.
CPD-HUD

Richard W. Krimm, Assistant Adm., FIA

developed to minimize adverse environmental and social impacts both above and below the dam. The purpose of the 4-foot raise of Lake *Darling Dam is not flood control* but mitigatory, to reduce the need for flood control storage behind Burlington Dam and thereby reduce adverse impacts on the Fish and Wildlife Refuges impoundments located below the Lake Darling Dam within the Burlington reservoir storage area.

8. Residential category damages and benefits were evaluated after the 1969 flood based upon actual damages reported through the city assessor's office, field appraisals and interviews. Generalized depth vs damage curves are not the basis for Burlington Dam Study economics. A separate response to the referenced letter dated 20 October 1977 has been provided

9. We are well aware of the 6 5/8 percent interest rate current' prescribed by the Water Resources Council in evaluating the economics of water resources projects and the impact of the interest rate on the benefit-cost ratio. An interest rate of 5 1/8 percent was used in evaluating the economics of this particular project on the basis of approval by the Office, Chief of Engineers. Design Memorandum No. 2 indicates that the project would generate an interest rate return of 7 percent. Thus, the project has a favorable benefit-cost ratio of 1.06 evaluated on the basis of 6 5/8 percent interest rate. This has been added to Design Memorandum No. 2.

United States Department of the Interior

In Reply Refer To:
ER 77/1004

December

Colonel Forest T. Gay, III U.S.A.
District Engineer
St. Paul District
Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

This responds to your request for the Department of the Interior's review of the General Design Memorandum ... and the Draft Environmental Impact Statement on the ... Dam Project, North Dakota (ER 77/1004).

GENERAL DESIGN MEMORANDUM

General Comments

The Fish and Wildlife Service evaluated and reported on essentially the same plan as contained in the GDM in April 1977. With one exception, which will be discussed later, the recommendations ... forth in the letter to the District Engineer, to mitigate damages to fish and wildlife habitat and wildlife refuge facilities are included in the recommended plan described in the GDM.

1\. Recreation is not a project purpose in the ... Flood Control project; however, Recreation Planning ..., where the project is located, has a need for 1,014 campsites, ..., and 7 miles of bicycle trails in 1980. Since the Corps will be acquiring some recreation land and facilities while flooding others, we recommend the Corps work cooperatively with local government entities to try to fill some of these recreation needs. For instance, a bicycle trail might be placed on top of some levees near urban areas.

... Comments ... of the ... Department of the Interior Comment

1\. Comments specifically addressing the ... Memorandum ...

Specific Comments

Page 13, middle paragraph. The statement indicates the Corps will acquire some private and public properties in Renville County Park. We recommend the monies for public property be earmarked for Federal park and development of other recreation facilities. In addition, where nature access facilities are provided, the Corps should show where facilities are located, the cost of development, and the benefit to recreation.

Page 53 of the GDM states that the plan includes removal of the headquarters buildings of the Upper Souris Refuge and the replacement with new buildings at a different site. However, on page 8 of the DES it is stated that these buildings would remain. This inconsistency in the two statements should be resolved.

There were several unresolved issues discussed in the Fish and Wildlife Service's April 25, 1977, letter. These issues have subsequently been resolved with the Corps as evidenced by the Service's letter of September 8, 1977, to the District Engineer. However, several matters pertaining to fish and wildlife (impacts on aquatic habitat, carp control facilities, design of refuge dikes, spillways and control structures) will need to be worked out during the advanced design phase of the project.

Page 67. "In addition to flood control benefits, the construction of Burlington Dam and related works would permit development of the flood plain upstream and downstream from Minot, particularly for residential uses and create a location benefit." Suggesting residential development of the flood plain is in conflict with Executive Order 11988, dated May 24, 1977.

> Section 1. Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

We suggest that recreation and open space parkways are appropriate land uses to reduce the risk from flood loss.

Page 92, Recreati[illegible] camping, picnicki[illegible] North Dakota (CDM [illegible] Planning [illegible] No. [illegible]

DRAFT [illegible]

General Comments

2. For the most part the Draft Environmental [illegible] Statement is a well written document. The impacts pertaining to the [illegible] and wildlife resources are described objectively and [illegible] with the Fish and Wildlife Service evaluation of [illegible] resources. However, the draft statement [illegible] detailed information on recreation and aesthetic losses and the [illegible] will initiate to reduce the impacts. Although there are several alternatives to the *recommended* plan which would have been environmentally less damaging, we believe the tradeoffs have been fairly presented in the draft.

Specific Comments

3. Page 8, paragraph 1.06. The last sentence in this paragraph states that the Upper Souris Refuge headquarters buildings are above elevation 1[illegible] and will remain, while the GDM states they will be removed and replaced with new buildings at a different location. As pointed out earlier these conflicting statements in the two documents should be corrected.

4. Page 8, paragraph 1.08. In connection with raising Lake Darling Dam 4 feet, the existing low flow conduit and gate will be removed and replaced with a new structure capable of passing 5,000 cfs at the left abutment. Since the existing structure furnishes the water supply for Pool A, from which water is passed down to Pools [illegible] and C, provisions must be made to provide a new conveyance system to provide water to Pool A.

5. Page 9, paragraph 1.09 and 1.10. A preliminary meeting was held [illegible] November 16, 1977, between the Corps and the Fish and Wildlife Service to discuss refuge embankment and structure modifications. At that meeting, basic criteria and objectives were established for operation of all Upper Souris and J. Clark Salyer Refuge units during periods the raised Lake Darling Dam or Burlington Dam would be in a flood control operation. Specific design features will be developed to achieve Fish and Wildlife Service objectives. The principal objectives are to modify these dams and structures so that reservoir releases can be passed without damage, inundation will not cause failure of dikes, and operational levels can be reached as early as possible.

[illegible] (cont)

[illegible] Responses to the [illegible] statement [illegible] comment [illegible] [illegible] A discussion of the aesthetic impacts [illegible]

3. The statement in the draft [illegible] correct. The inconsistency between the two documents has been corrected.

4. The Corps recognizes the necessity [illegible] water to Pool A. Measures will be developed to provide water to Pool A in the detailed design studies (Phase II GDM).

5. The Corps is in full a[illegible] with the objectives to modify the dams and structures so that reservoir releases can be passed without damage and that operational levels be reached as soon as possible. The measures that have been proposed are of a preliminary nature and are subject to further refinement in the Phase II detailed design studies.

6. Page 9, paragraph 1.11. The acreage of drained wetland complexes should be 13,600 instead of 13,000.

7. Page 16, paragraph 1.35. We believe there should be project imposed restrictions on future development in the flood plain in downstream areas. Unregulated future development in the flood plain in those areas that have not adopted flood plain regulations and do not participate in the National flood insurance program is likely to increase pressure to reduce the release rates from Burlington or Lake Darling Dams. This would increase the duration of floodwater storage and cause greater environmental damages downstream.

8. Page 18, Table 1, Footnote 2. This footnote states that the cost of purchasing the mitigation lands is $1,793,000. It is our understanding that this figure includes not only the cost of acquisition of the 2,000 acres of drained wetland complexes, but also the development costs of the wetland complexes and the establishment of the 1,000 acres of trees on project lands.

A description of the economic geology of the region is contained in the draft environmental statement (pp. 25-27). Resources mentioned include lignite, oil and gas, salt, and common variety mineral commodities, such as sand and gravel, brick clay, and glacial boulders.

9. We are pleased to note the following paragraph on page 84 of the statement:

> Economic mineral deposits affected would be restricted to those deposits of sand, gravel, boulders, and clay used for the construction of the proposed structures. The projects would not, however, significantly deplete the regional supply of these materials. The projects would have no effect on the production and future development of lignite, oil or gas.

Inasmuch as an examination of library and file data revealed no significant mineral involvement in the project area, we concur with the above statement except to suggest that salt be included with lignite and oil and gas.

10. Page 51, Table 7. Even though the data presented were taken from an Upper Souris Refuge wildlife report, it is unlikely that there were any cinnamon teal use-days. This species is only an accidental visitor to the Souris loop. In any event, if they are to be listed with teal, they should be lumped with blue-winged rather than green-winged teal. Also, the harlequin duck use-days should be deleted from the table. According to the Souris loop bird list, harlequin ducks have never been recorded on any of our refuges in the area.

6. This change has been made, see paragraph 1.11 of the final EIS.

7. Concur. However, the Corps of Engineers has no authority to impose floodplain regulations on the State or local units of government. This authority rests with the State and local units of government themselves. In the absence of a State floodplain regulations program one item of local cooperation agreements calls for the local interests to provide "guidance and leadership in preventing unwise future development of the floodplain by use of appropriate floodplain management techniques to reduce flood losses from the Burlington dam site downstream to the New Prairie-Sundre Township line near Logan." The intent of this item of local cooperation is to encourage local governments to restrict damageable development in that reach of the Souris River (100 year modified floodplain) where there is the greatest potential for growth. Another item of local cooperation calls for the local sponsor to "prescribe and enforce regulations to prevent encroachment on downstream channel capacities for regulation of the reservoirs; and, if improved drainage channel capacities and ponding areas for interior drainage are impaired, provide substitute storage capacity or equivalent pumping capacity promptly without cost to the United States."

8. Concur. This information has been clarified in footnote 2 of table 1 in the final EIS.

9. *This change has been made in the final EIS, see paragraph 4.12.*

10. The reference to cinnamon teal and harlequin duck use-days has been deleted from table 7 in the final EIS.

5

11\. Page 5[illegible], Table [illegible] [illegible] from this [illegible] or at least [illegible] with [illegible]

12\. Page 59, paragraph [illegible] Insert the [illegible] after [illegible] River in the fourth sent[illegible] . . . . "and [illegible] in the Souris River as far upstream as [illegible], Manitoba."

13\. Page 71, paragraph 2.162. "With [illegible] potential to create a larger park and open space system along [illegible] created. Plans for the system have been developed." The [illegible] Recreation would encourage any attempt to create more open [illegible] recreation areas for public use.

14\. We are pleased with the extent to which [illegible] resources have been considered in the subject statement. We [illegible] that an intensive survey of the proposed project area is planned for the [illegible] design phase (environmental statement, page 72). To facilitate review, the final statement should discuss in detail the results of this investigation. All sites recorded as a result of this work should be evaluated against the criteria for inclusion in the National Register of Historic Places (36 CFR 800).

15\. Documentation of consultation with the State Historic Preservation Officer concerning any sites recommended for the National Register should also be included. If any archeologi[illegible]l or historic properties within the proposed project area are listed, nominated, or formally determined to be eligible for inclusion in the National Register, the final statement should include documentation of actions taken to comply with Section 106 of the National Historic Preservation Act of 1966 as codified in the "Procedures for the Protection of Historic and Cultural Properties" (36 CFR 800).

16\. Page 8[illegible], paragraph 4.25. In this paragraph [illegible] carp, we would like to point out that carp are regul[illegible]ly [illegible] in the Souris River in Manitoba downstream from a series of [illegible]. They have been caught by fishermen at Melita, Manitoba, [illegible] point they would have surmounted five of the six lowhead [illegible]. [illegible] that reservoir releases of 500 cfs plus local inflow will [illegible] all of these dams during the summer. When water temperatures are sufficiently warm spawning carp will migrate upstream past Dam [illegible] into Salyer Refuge, unless an effective barrier is installed. Although reservoir releases through the winter would likely assure carp survival in Salyer Refuge and upstream, there is a possibility carp might survive without high winter releases. The point it that a [illegible] considerably less than a 100-year flood may cause introduction of [illegible] into the U.S. portion of the Souris River under the modified conditio[illegible] by Burlington Dam. Back to back floods would greatly increase the likelihood of carp introduction.

[illegible] U.S. [illegible] Comments (Cont)

11\. The reference to [illegible] has been delet[illegible] from table 9.

1[illegible]. The suggested addition [illegible].

1[illegible]. Comment noted. No response necessary.

14\. [illegible] paragraphs 2.[illegible].

15\. [illegible] paragraphs 2.[illegible] to 2.[illegible].

16\. The conceptual plan for carp control at structure number 3[illegible] in the J. Clark Salyer NWR involves modificati[illegible] of existing culvert inlets and extending the length [illegible] the culverts. The plan would be designed to prevent migration at the maximum summer release of 500 cfs plus local inflow. The appropriate head differential at the structure is 5 feet. In developing criteria for carp control the only data available pertained to the migration of salmon. Using this criteria, the 100 foot culverts with drop inlets would require velocities of almost 5 feet per second or greater.

Burlington Dam should have no direct effect on any projects of the Bureau of Reclamation; however, page 88, paragraph 4.25, acknowledges that the U.S. Fish and Wildlife Service has expressed concern that Garrison Diversion Unit return flows would enable carp to enter the Souris River from Canada and overwinter in marsh impoundments of J. Clark Salyer. During years of extended releases from Burlington Dam, conditions favoring fish survival would exist with or without return flows. The Corps plan includes a "high velocity culvert to prevent passage during lower flows." Details of the culvert such as velocity, length, and head are needed before we are able to judge the probable effectiveness of the culvert or its potential for altering river flows to which Garrison Diversion Unit flows are added.

17. If the device is not successful, mitigation measure to compensate for losses to waterfowl habitat in J. Clark Salyer National Wildlife Refuge caused by Garrison Diversion Unit may be inappropriate or unnecessary.

18. Page 104, Recreation Impacts, paragraph 4.77. The Corps of Engineers acquire and remove damageable recreation property at Mouse River Park. The Corps should definitely cooperate with a local sponsor to replace these recreation losses.

19. Page 104, paragraph 4.77. "Flooding would require the temporary removal of picnic facilities and would require clean-up operations after flooding at the three boat landings on Lake Darling, Grano Crossing (bank fishing and picnicking), and Greene Crossing (bank fishing and picnicking)." The Grano Crossing is a recreation site funded by Land and Water Conservation Funds. Occasional flooding of this site would be a change of land use. This would be a violation of Section 6(f) of the Land and Water Conservation Fund Act of 1965, as amended. *Section 6(f) permits no changes from* recreational land use in a park so assisted without approval of the Secretary of the Interior. The Secretary can approve such a conversion only if it is in accord with the State Comprehensive Outdoor Recreation Plan (SCORP), and then only upon the substitution of other properties of at least equal fair market value and reasonable equivalent usefulness and location. There is no provision under this section for acceptance of cash in payment for other areas.

20. We suggest the Corps contact Mr. Tim Mueller, Acting State Liaison Officer for North Dakota, for more information about projects in North Dakota constructed with Land and Water Conservation Funds. Mr. Mueller's address is State Outdoor Recreation Agency, RR#2, P.O. Box 139, Mandan, North Dakota 58554.

21. Page 104, paragraph 4.79. The periodic flooding of recreation areas will create a health hazard and sanitation problem. What techniques are

17. Comment acknowledged.

18. The Corps has initiated coordination efforts with Renville County to examine future options available to minimize the adverse effects of the project on existing recreation developments. These efforts as well as a complete analysis of the recreation potential of the Burlington project will be conducted during the Phase II detailed design studies. Existing Federal Law (Flood Control Act of 1944 as amended, and the Federal Water Project Recreation Act of 1965, P.L. 89-72) allows the Corps of Engineers to participate in recreation development at water resource projects provided non-Federal interests express willingness to participate in such developments.

19. Subsequent correspondence with the Department of the Interior (USDI) and the Bureau of Outdoor Recreation (BOR) has indicated that impacts on the Grano Crossing recreation site do not constitute a Section 6F conflict. See also the 27 December 1977 letter from the USDI and the 22 December 1977 attachment letter from the BOR to the USDI.

20. See above response.

21. See response to 22 December 1977 letter from the Bureau of Outdoor Recreation.

planned by the Corps to protect the tree water [illegible] or filtering systems and restrooms at the various recreation [illegible] Would flood-proofing be feasible or practical? The final statement should explain the protective measures that will be initiated to maintain safe and sanitary recreation sites.

22. Page 104, paragraph 4.79. In addition to fishing and picnicking areas at Baker Bridge and St. Mary's Bridge that would be affected by inundation, the fishing and picnicking area along the river just downstream from Lake Darling Dam would be impacted by the new outlet works. The extent of the damage to this area is not known, but at a minimum it would include the loss of the access road and parking area. The access road, parking area, and perhaps the entire recreation area, will need to be relocated.

23. Page 109, Section 505, Unavoidable Adverse Impacts of the Proposed Plan. The aesthetic and environmental impacts appear quite large, with losses or damages to many acres of vegetation such as:

1. 300 acres of bottomland hardwoods located within the design pool above Lake Darling Dam would be seriously damaged or destroyed due to storage of a one percent chance flood.

2. 450 acres would be destroyed by an inundation of over five months.

3. 1,500 acres of wetlands above Lake Darling Dam are subject to increased flood damage.

4. 3,600 of marshland would be inundated for an entire growing season, for flood requiring storage behind Burlington Dam.

5. Approximately 2,350 acres of grassland including the Des Lacs Valley would be affected.

6. Removing trees along 3,000 feet of channel and 25 to 35 acres of trees in channel cutoff areas.

24. Page 115, paragraph 6.19. The categorical claim in the second sentence that states "Lake Darling Dam is currently unsafe" should be modified or deleted. Although the dam might be breached during an extremely large flood, it has not been proven that it is unsafe.

25. The Environmental Quality Plan, Alternative 1[illegible], appears more acceptable to the Bureau of Outdoor Recreation than Alternative 10, the Corps' recommended plan.

Corps Responses to U.S. Department of the Interior Comments (Cont)

22. These areas, which contain an access road, parking lot and picnic tables, may be adversely affected by the new structure proposed for the Lake Darling dam. Accordingly, when the design work for the structure has been completed, further coordination with the FWS will be conducted to determine the need for mitigating measures. Such measures, if found necessary, will be provided for a project cost.

23. A section discussing the aesthetic [illegible]ts of the project has been added to the final EIS. (See paragraphs 4.116 to 4.119.) It should be noted that item 6 is incorrect--only 5 acres of trees would be removed in the channel cutoff areas. This information has been corrected in the final EIS.

24. The cited sentence has been deleted from the final EIS.

25. Your comment is acknowledged and will be taken into consideration in the decision making process.

8

The Bureau of Outdoor Recreation prefers Alternative 15 for [illegible] reasons.

1. The Environmental Quality (EQ) plan addresses the planning objectives in a way that emphasizes aesthetic, ecological and cultural contributions more than any other alternative.

2. Construction of the upstream diversion structure would result in minor adverse impacts to the natural communities upstream of Minot.

3. While the EQ alternative does not provide as high a degree of flood protection from floods originating on the Upper Souris River as do those alternatives that contain a large dam on the Souris River, the degree of protection from those areas with rapid runoff is increased over many other alternatives. The EQ alternative provides Minot with a degree of protection from all sources of about 110 years.

4. The EQ alternative is not without adverse impacts to the natural environment. These impacts are to a large degree temporary in nature and/or would occur in areas already greatly disturbed by man.

5. The EQ alternative would require no mitigation for environmental losses since there would be a net positive contribution to the environment, as opposed to a net loss for almost every other structural alternative.

6. The purchase and removal of 80 seasonal residences and several recreational buildings in Renville County Memorial Park would not be required by this plan.

7. The EQ plan yields more positive contribution than detrimental effects to social well-being, and is therefore regarded as a socially acceptable plan because it confers economic, social, and flood control benefits upon those who would be obligated to sacrifice property ownership, modes of orientation to work and family, and other value commitments for an increased protection from flooding.

8. The kinds of construction would be more varied than with other plans, thus spreading benefits over a wider sector of the population.

9

Even though the EQ plan has a benefit-cost [illegible] environmentally, socially, and aesthetically, the [illegible] plan most acceptable.

Summary

We have noted in our previous comments that [illegible] job in preparing the EIS and that the [illegible] Fish and Wildlife Service have been made [illegible] part of the [illegible]. We believe it is appropriate, however, to [illegible] our concern [illegible] the recent widespread attacks on the wildlife [illegible] plan for the Burlington project by persons or groups [illegible] total project.

26. These attacks have been directed [illegible] acquisition of [illegible] 2,000 acres of drained wetland complexes. We [illegible] strongly resist, along with the Corps, pressures to modify the [illegible] and Wildlife [illegible] mitigation plan or to allow imposition of conditions on the eventual selection of specific tracts of land that would make achievement of the 2,000-acre goal impossible.

27. One of the recommendations in the Fish and Wildlife Service report of April 1977, was not addressed in either the GDM or EIS. That recommendation called for the formulation of a General Plan pursuant to the Fish and Wildlife Coordination Act for management of appropriate project lands and waters for wildlife conservation purposes. The Service could not be specific at that time as to what lands should be covered by a General Plan because real estate plans were not firm. Since the Corps has now decided to acquire fee title to lands below the 100-year flood pool, we believe both documents should express the intent to dedicate suitable project lands not required for primary project purposes to wildlife conservation purposes under a General Plan.

28. For both the General Design Memorandum and the Environmental Impact Statement, Engineering (FWS) may have comments at a later date. There are still some questions on the replacement of refuge structures and the reservoir plan of operation.

Sincerely yours,

John [illegible]
Regional Environmental Officer

Corps Responses to [illegible] Department of the Interior Comments (continued)

26. Comment acknowledged. The St. Paul District, [illegible] of Engineers considers the mitigation plan to be an integral part of the proposed project.

27. Proper consideration will be given to develop [illegible] which is consistent with the aims and objectives of the National Wildlife Refuge System during the Phase II [illegible].

28. The Corps intends to fully coordinate the planning, design and development of the final reservoir operation plan with the Department of the Interior. Much of this will be done during the Phase II detailed design studies.

United States Department of the Interior
OFFICE OF THE SECRETARY
MISSOURI BASIN REGION
DENVER, COLORADO 80225

ER 77/1004

December 27, 1977

Colonel Forest T. Gay, III, U.S.A.
District Engineer
St. Paul District
Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

By letter dated December 12, 1977 the Department of the Interior provided review comments on the General Design Memorandum and Draft Environmental Statement on the Burlington Dam Project, Souris River, Ward, McHenry, and Renville Counties, North Dakota. Subsequent to the December 12th letter the attached memorandum was received from the Bureau of Outdoor Recreation, Department of the Interior, modifying their comments which had been incorporated in the letter on page 6, paragraphs 3, 4 and 5.

It is suggested that the attached letter serve as an addendum to our letter of December 12.

If we can be of further assistance, please call.

Sincerely yours,

John E. Raybourn

John E. Raybourn
Regional Environmental Officer

Enclosure

FK

United States Department of the Interior
BUREAU OF OUTDOOR RECREATION
MID-CONTINENT REGION

MAILING ADDRESS: Post Office Box 25387, Denver Federal Center, Denver Colorado 80225
STREET LOCATION: 603 Miller Court, Lakewood Colorado, Telephone 234-3644

IN REPLY REFER TO:
G26
38-00123

DEC 2 2 1977

Memorandum

To: John Raybourn
Regional Environmental Officer, Missouri Basin Region

From: Assistant Regional Director, Land Use Coordination
Mid-Continent Regional Office

Subject: Review of the General Design Memorandum and Draft Environmental Statement on the Burlington Dam Project, Souris River, Ward, McHenry, and Renville Counties, North Dakota (ER-77/1004)

This is to supplement our comments of December 8, 1977, on the subject draft environmental statement. After further discussion with State, Fish and Wildlife Service, and Corps of Engineers staffs, we have determined that flooding resulting from construction of the Burlington Dam Project will not constitute a 6(f) conversion of Land and Water Conservation Fund Project No. 38-00123, Grano Crossing.

1. We have been informed that Lake Darling will continue to be operated at the current water level and that a 100-year flood would only inundate the Grano Crossing area for a two-day period. This being the case, we have indicated to the Corps of Engineers that the only mitigation measures necessary on this project would be to either relocate the restrooms and the water treatment facility or make them adequately flood-proofed.

Robert J. Arkins

DEPARTMENT OF INTERIOR
RECEIVED
DEC 2 3 1977
OFFICE OF THE SECRETARY
MISSOURI BASIN REGION
DENVER, COLORADO

Corps Responses to Bureau of Outdoor Recreation Comments

1. Although not included specifically ... we concur with the views expressed by the BOR. Rather ... substitute facilities in the Grano Park, ... floodproofing damageable development in the parks will be ... responsibility. The details of the floodproofing measures will be determined during the ...

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION EIGHT

P. O. Box 1755
Bismarck, North Dakota
December 7, 1977

HEC-ND

Colonel Forrest T. Gay, III
District Engineer
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

1 We have reviewed the Draft EIS for the Burlington Dam on the Souris River in North Dakota. We found the information on road relocations to be very sketchy and are unable to determine which roads you plan on raising above the 100-year flood by reading the Draft EIS supplemented by Design Manual No. 2.

2 On page 76 in Design Manual No. 2, you indicate that there will be a total of four road raises. However, on page 97 of the same document, while you list four relocations, you indicate that Ward County Road 32 (FAS Route 929) will be deleted. We agree that road raises will be required on SH 5 (FAP 5), SH 28 (FAS Route 752) and on Renville County Road 9 (FAS Route 729). However, it also appears that some modifications will have to be made to Renville County Road 28 (FAS Route 471) and to Renville County Road 38 which is the same route as Ward County Road 26 (FAS Route 932) which crosses the Lake Darling Dam. If these roads are closed or abandoned, the negative impacts, if any, should be shown.

3 Since we are unable to determine the status of the above roads and we have heard from the highway department that there is presently discussion to close SH 28 (a route which was recently upgraded), we find the discussion presented in the EIS and Design Manual No. 2 to be inadequate. Some of this misunderstanding may be cleared up when you issue Design Manual No. 19 scheduled for November 1980. However, the general discussion of roadway relocations should be more understandable than what has been presented.

4 There have been some changes to the Federal-aid system numbering. In the above paragraph, we used the old system which corresponds to that used in the EIS. The new numbers are as follows:

Corps Responses to U.S. Department of Transportation Comments

1. The "old" Federal-Aid numbers and the County Road and State Highway numbers have all been included in order to provide a clearer description of the road raises that are being proposed.

2. The original authorized plan provided for raising two roadways: FAS 929 and SH 5. Under the current proposal, four roads would be raised. The proposed raises include FAS 932, SH 28, FAS 729, and SH 5, as proposed in the authorizing document. The proposed raise of FAS 929 has been deleted due to a revision in the reservoir's operating plan, which provides for less frequent inundation. Only two crossings, St. Mary's and Harrington's bridges, are proposed to be abandoned under the current proposal. It is believed that the impacts of abandoning these two lightly used crossings would be minimal.

3. The roadway relocation plan, as outlined in this EIS and the Phase I GDM, is preliminary in nature and subject to further refinement as the studies progress. During preparation of Design Memorandum No. 19, comprehensive studies would be made of all roadways in the reservoir, including FAS 471 and SH 28.

4. Comment noted. As previously stated, the County Road and State Highway numbers have been included along with the Federal-Aid numbers in the GDM and final EIS. Future reports will also include the new Federal-Aid numbers.

4

Route	Old F.A. No.	New F.A. No.
SH 5	FAP 5	FAP 5
SH 28	FAS 75[illegible]	FAS 28
Renville County Road 9	FAS [illegible]	FAS 33[illegible]
Renville County Road 28	FAS 47[illegible]	FAS [illegible]28
Renville County Road 38	FAS 932	FAS [illegible]
Ward County Road 26	FAS 932	FAS [illegible]126
Ward County Road 32	FAS 929	FAS [illegible]132

We appreciate the opportunity to review the Draft EIS and hope that our comments will stimulate coordination at an early time and clear any misunderstandings at a later time.

Sincerely yours,

George H. Seaworth, P.E.
Division Administrator

FEDERAL ENERGY REGULATORY COMMISSION
Federal Building - 31st Floor
230 South Dearborn Street
Chicago, Illinois 60604

December 13, 1977

Colonel Forrest T. Gay III
District Engineer
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Your Reference: NCSED-PB

Dear Colonel Gay:

We have reviewed the Draft Environmental Impact Statement entitled "Flood Control Burlington Dam, Souris River, North Dakota" which you sent for our comments with your October 25, 1977 letter.

The comments of this office are made in accordance with the National Environmental Policy Act of 1969 and the August 1, 1973 Guidelines of the Council on Environmental Quality. Our review of the statement is principally oriented toward determining the effect of the proposals on matters related to the Commission's 1/ responsibilities. These responsibilities pertain to the development of hydroelectric power, the assurance of the reliability and adequacy of bulk electric power facilities, and the construction and operation of natural gas pipeline facilities. The comments which follow are those of the Federal Energy Regulatory Commission's, Chicago Regional Office, and therefore do not necessarily reflect the views of the Federal Energy Regulatory Commission.

Our review of the statement indicates that the proposed plan for flood damage reduction on the Souris River includes constructing the Burlington Dam near Burlington, North Dakota, raising the Lake Darling Dam located above the Burlington damsite, and making various local flood protection improvements.

1/ On October 1, 1977, pursuant to the provisions of the Department of Energy Organization Act (DOE Act), Public Law 95-91, 91 Stat.565 (August 4, 1977) and Executive Order No. 12009, 42 Fed. Reg. 46267 (September 15, 1977), the Federal Power Commission ceased to exist and its functions and regulatory responsibilities were transferred to the Secretary of Energy and the Federal Energy Regulatory Commission (FERC) which, as an independent commission within the Department of Energy, was activated on October 1, 1977.

The staff of the Commission's Chicago Regional Office has previously considered the possibility of including hydroelectric power facilities at the proposed Burlington Dam in connection with the review of your February 1969 report, "Review Survey of Souris River, North Dakota." Because nearly all of the reservoir storage was allocated for [illegible] control and the impracticability of raising reservoir elevations for [illegible] nal storage, together with low average annual flows in the Souris [illegible] concurred with the statement in the report that future hydro[illegible] power development in the Souris River Basin would be unlikely. We [illegible] that there effectively will be no storage at the Burlington proje[illegible] will only be stored from those floods that have a recurrence [illegible] less than 2 percent. The economic development of hydropower [illegible] ture precluded at the site.

1. Although there are no existing or potential hydroelectric power sites listed in the Commission's November 1976 edition of "Hydroelectric Power Resources of the United States," it may be possible to install hydroelectric power facilities at the Lake Darling Dam, particularly, if fuel [illegible] associated with other forms of generation rise and continue to improve the economic competitiveness of hydropower. The economic feasibility of installing hydroelectric facilities at Lake Darling could be adversely affected by Burlington reservoir's operating plan because it allows the complete inundation of the Lake Darling Dam when very large fl[illegible] occur. Since the development of hydropower has been found to be unattractive, the basin's power requirements have been, and are expected to be, largely supplied by thermal-electric generation outside of the area and by hydro-electric generation on the main stem of the Missouri River. Our records show that there are no steam-electric plants which depend on the Souris River as a source of cooling water supply.

2. The Statement indicates that utilities within the area to be inundated by the proposed Burlington Reservoir would have to be removed or relocated and that there are significant estimated yields of gas within the Souris Basin. Our records show that there also are existing and proposed bulk power transmission facilities and existing gas pipelines in the vicinities of the proposed Burlington Dam and Reservoir and recommended improvements. Neither the proposed Burlington development nor the recommended improvements appear to pose a major obstacle to the construction and operation of the foregoing facilities or the future development of facilities for extracting the natural gas resource. However, it is suggested that appropriate measures be taken in regard to such matters as maintaining clearances and minimizing any necessary disruption of electric power and gas supply.

Thank you for the opportunity to comment on the draft environmental statement. We will send separate comments on the "Design Memorandum No. 2 - Plan Formulation" for the project.

Very truly yours,

Bernard D. Murphy

Bernard D. Murphy
Regional Engineer

Corps Responses to Federal Energy Regulatory Commission Comments

1. It is the Corps of Engineers basic position that hydropower be developed whenever feasible. However, based on comments received on the draft EIS, it is recommended that the development of hydro-power facilities at Lake Darling dam be a long-range consideration. Accordingly, it is recommended that when and if the Burlington dam project is completed, a separate study of hydro-power development at Lake Darling be conducted. This study would have to be coordinated with the U.S. Fish and Wildlife Service.

2. [illegible] Appropriate measures will be taken for the relocation or protection of [illegible] located within the reservoir area. [illegible] ther detailed as the studies progress [illegible] will [illegible] dinated with the responsible interests [illegible] agencies.

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

November 16, 1977

Colonel Forrest T. Gay III
District Engineer
St. Paul District
Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Thank you for your request of October 25, 1977, for comments on the draft environmental statement (DES) for proposed Flood Control, Burlington Dam, Souris River, North Dakota. Pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 and the Council's "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800), we have determined that your draft environmental statement mentions properties of cultural and/or historical significance; however, we need more information in order to evaluate the effects of the undertaking on these resources. Please furnish additional data indicating:

Compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f, as amended, 90 Stat. 1320).

The DES must demonstrate that either of the following conditions exists:

1. No properties included in or that may be *eligible for inclusion in* or which have been determined on the authority of the Secretary of the Interior to be eligible for inclusion in the National Register of
1 Historic Places are located within the area of environmental impact, and the undertaking will not affect any such property. In making this determination, the *Council* requires:

—evidence that you have consulted the latest *edition* of the National Register (Federal Register, February 1, 1977, and its monthly supplements);

—evidence of an effort to ensure the identification of properties eligible for inclusion in the National Register, including evidence

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

Corps Responses to Advisory Council on Historic Preservation 16 November 1977 Comments

1. See paragraph 2.173 to 2.179.

of contact with the State Historic Preservation Officer, whose comments should be included in the final environmental statement. The State Historic Preservation Officer for North Dakota is James E. Sperry, Superintendent, State Historical Society of North Dakota, Liberty Memorial Building, Bismarck, North Dakota 58501.

2. Properties included in or that may be eligible for inclusion in or which have been determined on the authority of the Secretary of the Interior to be eligible for inclusion in the National Register of Historic Places are located within the area of environmental impact, and the undertaking will or will not affect any such property. In cases where there will be an effect, the final environmental impact statement should contain evidence of compliance with Section 106 of the National Historic Preservation Act through the Council's "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800).

Should you have any questions, please call Brit Allan Storey at (303) 234-4946, an FTS number.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

Advisory Council on
Historic Preservation
1522 K Street N.W.
Washington, D.C. 20005

December 12, 1977

Colonel Forrest T. Gay III
Corps of Engineers, St. Paul District
U.S. Department of the Army
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

The Council has received the Corps of Engineers' draft environmental statement (DES) for Flood Control, Burlington Dam, Souris River, North Dakota, which is dated October 1977. Pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969 and the Council's "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800), we have determined that your DES is inadequate because it does not demonstrate compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f, as amended, 90 Stat. 1320). However, we note that the Corps has developed a program which will identify cultural properties and nominate them to the National Register of Historic Places prior to implementation of this undertaking. We wish to remind the Corps that if properties determined eligible for inclusion in the National Register will be affected by this proposed undertaking, the Corps is required to afford the Council an opportunity to comment on the undertaking. For your information, steps to determine eligibility, effect, and obtain Council comments are detailed in the "Procedures for the Protection of Historic and Cultural Properties" (36 C.F.R. Part 800), a copy of which is enclosed for your convenience.

Should you have any questions or require assistance with this matter, please contact Brit Allan Storey of the Council's Denver staff at (303) 234-4946, an FTS number.

Sincerely yours,

Louis S. Wall
Assistant Director, Office of
Review and Compliance, Denver

Enclosure

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

NORTH DAKOTA GAME AND FISH DEPARTMENT

PHONE - 224-2180

November 23, 1977

Mr. J.R. Calton, Chief
Planning Branch, Engineering Division
Department of the Army
1135 U.S. Post Office & Custom House
St. Paul, MN 55101

Re: Flood Control-Burlington Dam
Souris River, North Dakota

Dear Mr. Calton:

The Game and Fish Department has completed its review of the Draft EIS and Design Memorandum No. 2, (Phase 1 - Plan Formulation) Flood Control Burlington Dam, Souris River, North Dakota. We believe project related impacts on fish and wildlife resources have been adequately addressed in the documents and concur with the wildlife mitigation plan as developed. This includes, among other items, restoration of 2,000 acres of drained wetlands and 1,000 acres of tree plantings on project lands.

1. We were pleased to find that our earlier recommendation of annual funding for tree cultivation was included in the operation, maintenance and replacement cost budget. Although not specifically listed as a "first cost" item, we also assume money has been included for fencing of mitigation sites. We believe this should be the Corps' responsibility.

Thank you for the opportunity to review this Draft EIS and Design Memorandum.

Sincerely,

Russell W. Stuart
Commissioner

RWS:lr
cc: FWS (Simpson)

Corps Responses to North Dakota Game and Fish Department Comments

1. Fencing of mitigation lands has been included in the project cost estimate, in accordance with recommendations made by the U.S. Fish and Wildlife Service (see letter report dated 25 April 1977 in the technical appendix).

NDSIC FORM B (9/71)

PNRS NO. 77-867
Date Received

RECEIVED
NOV 28 1977

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: _ WILLIS VAN HEUVELEN
STATE HEALTH DEPARTMENT
_ STATE CAPITOL
BISMARCK ND 58505

ISSUED BY: Department of the Army

DATE: November 1, 1977

NAME OF PROJECT: Draft EIS & Design Memorandum No. 2, (Phase 1 - Plan Formulation) Flood Control Burlington Dam, Souris River, North Dakota

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

- [ ] No comment
- [ ] Meeting desired with applicant
- [x] Comments submitted herewith

....

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: Jeffrey Hauge Date: 11/25/77
Title: Environmental Engineer Tele: 224-2354

Environmental Control
DIVISION OF WATER SUPPLY AND POLLUTION CONTROL
Norman L. Peterson, P.E.
Director
170 224 2354

North Dakota State

Department of Health

Missouri Office Building
1200 Missouri Avenue
Bismarck, North Dakota 58505

JONATHAN B. WEISBUCH, M.D.
State Health Officer

W. VAN HEUVELEN, Chief
Environmental Control

November 25, 1977

Mr. J. R. Calton, Chief
Planning Branch, Engineering Division
Department of the Army
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Mr. Calton:

COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT
FLOOD CONTROL BURLINGTON DAM, SOURIS RIVER, NORTH DAKOTA

In their environmental impact statement concerning the Burlington Dam, the Corps of Engineers is quite candid about the environmental effects of the dam. The analysis of the impact on aquatic and terrestial habitats is complete in that it is made clear that there will be a substantial amount of irreversible damage to both.

1. After reading the environmental impact statement, this Department is not convinced that all of the alternative plans can be reasoned away so easily as in this publication. In particular, Alternative 4, Minot Tunnel Diversion, and 5, Minot Channel Modification deserve more consideration. Both plans have a major plus in that construction activities would have the greatest impact upon a degraded portion of the Souris River. Channelization and diking in and around the Minot area have already disturbed both the aquatic and adjacent terrestial habitats of the river. Implementation of the plan similar to one of the above would accomplish the primary goal of flood control without the destruction of woodland and grassland and without the introduction of multidudious complications like interference with wetland management and flood plain regulation. In any other location, the amount of woodland destroyed by Burlington Dam might be insignificant; however, even this report emphasizes the quality of the environment and its significance in North Dakota.

Sincerely,

Jeffrey Hauge

Jeffrey Hauge
Environmental Engineer

JH:ff

Corps Responses to North Dakota State Department of Health Comments

1. It is recognized that the environmental damage with either of the local flood protection plans would be less than with the selected plan. However, the frequency of flood damage in Minot from the Souris River, the most common source of flooding, is once in 100 years with either of the local protection plans, whereas the selected plan provides near total protection from the Souris River. The local costs for the channel modification plan are $29.8 million and although the local costs are reduced to $5.17 million for the tunnel plan, the benefit-cost ratio is only marginal.

NDSIC FORM 8 (3/71)

SIRS NO. 77-867
Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

RECEIVED
DEC 15 1977
State Planning
Division

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: Mr. Edwin A. Noble, State Geologist
North Dakota State Geological Survey
University Station
Grand Forks, ND 58201

ISSUED BY: Department of the Army

DATE: November 1, 1977

NAME OF PROJECT: Draft EIS & Design Memorandum No. 2, (Phase 1 - Plan Formulation) Flood Control Burlington Dam, Souris River, North Dakota

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

☐ No comment ☐ Meeting desired with applicant

☒ Comments submitted herewith

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

See attached sheet.

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: [signature] Date: 12/2/77

Title: Geologist Tele: 777-2231

of the ... loss of these facilities ...

... project ...

... project ... flooding problem on the Souris River ... facilities will protect ... year" and "100-year" flooding ... The ... flooding risk will undoubtedly be accompanied ... additional construction on the floodplain. This, in turn, will ... greater destruction of property when "200-year" and "...-year" floods ... document considers the effects ... flooding events. This is critical to ... project.

... destruction of once in ... years, ... any one of the three ... 000 cfs independently. The ... induced damages at Minot as a function ... protection afforded.

NDSIC FORM B (9/74)

FNRS NO. 77-867
Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: Mr. Erling Brostuen
~~Geological Survey~~
UND
~~Grand Forks, ND 58201~~

ISSUED BY: Corps of Engineer

DATE: November 8, 1977

NAME OF PROJECT: Draft EIS & Design Memorandum No. 2, (Phase 1 - Plan Formulation) Flood Control Burlington Dam, Souris River, North Dakota

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

- [ ] No comment
- [ ] Meeting desired with applicant
- [x] Comments submitted herewith

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

Comments are attached.

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: Erling A Brostuen

Date: 12/5/1977

Title: Geologist

Tele: 777-2231

[illegible]

[illegible] and 19[illegible] [illegible]

[illegible] has been incre[illegible] in frequency [illegible]

1969, [illegible] neither draft discusses [illegible] fact[illegible]

A comprehensive study of the f[illegible] [illegible]y of the [illegible]River Basin, to properly assess cause [illegible] [illegible] should be undertaken before the authorized plan [illegible] are put into effect. Other, more viable alternatives may surface as a result of such a study.

The contribution that the drainage of wetlands has [illegible] to the flooding problem should be determined. It may be that wetlands drainage is the major contributory cause of flooding in the Basin. Restoration of drained wetlands in Saskatchewan and North Dakota should be included as an alternative. The mitigation by Canada for damages incurred by North Dakotans, as a result of wetlands drainage in the Province, should be considered, if justifiable.

[illegible] relation to the [illegible] [illegible] [illegible] wetlands will [illegible] [illegible] but does not necessarily [illegible] can be influenced more by the timing [illegible] flows from the various tributaries rather than [illegible] [illegible] drained wetlands.

[illegible] It is the [illegible] of the St. Paul District that increases in peak [illegible] drainage, up to the present time, is within [illegible] hydrologic data available. The Phase [illegible] Memorandum only provides a summary of the flood problems [illegible] Souris River Basin. A complete flood history in the Souris [illegible] is provided in Design Memorandum No. 1 - Hydrology and Hydraulic Analysis and supplement thereto.

[illegible] alleges that wetland drainage has had some effect [illegible] the magnitude and frequencies of flooding in the Souris River Basin. Such a study, as suggested, would be very [illegible] and [illegible] not necessarily produce accurate data from which valid conclusions could be drawn. Details concerning unrecorded and illegal drainage activities in both North Dakota and Saskatchewan would be difficult if not impossible to obtain. In view of the [illegible] generated by the current proposal--acquiring and restoring [illegible] acres of drained wetlands--it is obvious that the suggested alternative would not be implementable.

NDSIC FORM B (9/71)

PNRS NO. 77-867

Date Received

RECEIVED DEC 6 1977 State Planning Division

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: JAMES SPERRY
STATE HISTORICAL SOCIETY
LIBERTY MEMORIAL BUILDING
BISMARCK ND 58505

602
14

ISSUED BY: Department of the Army

DATE: November 1, 1977

NAME OF PROJECT: Draft EIS & Design Memorandum No. 2, (Phase 1 - Plan Formulation) Flood Control Burlington Dam, Souris River, North Dakota.

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

- [ ] No comment
- [ ] Meeting desired with applicant
- [x] Comments submitted herewith

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

see attached letter, Dill to Banks, 12/6/77

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: C. L. Dill

Date: 12/6/77

Title: Survey Archeologist(SHSND)

Tele: 701-224-2569

State Historical Society
of North Dakota

December 6, 1977

Mrs. Leonard E. Banks
Associate Planner
North Dakota State Planning Division
Capitol Building
Bismarck, North Dakota
58505

Re: Draft Environmental Impact Statement: Flood Control, Burlington Dam, Souris River, North Dakota.

Dear Mrs. Banks:

The State Historic Preservation Office of North Dakota (State Historical Society) has reviewed the above referenced document and has the following comments:

1 1. In reference to paragraphs 2.165, 2.166 and 4.81, we fully agree that intensive cultural resources surveys should be completed on the project areas prior to initiation of the final project design; it is unfortunate that these inventories were not completed prior to the writing of the Draft Environmental Impact Statement so that cultural resources could have been considered in more detail during planning of the project. Further, we believe that the "subsurface testing" referred to in paragraph 2.166 should include both the testing of recorded sites for purposes of evaluating their potential for the National Register of Historic Places, and the testing of areas within the project area which, although no surficial remains of cultural resource sites were located on them, appear to have potential for containing such resources. Identification of these areas can be accomplished through consultation with the archeological contractor and the final survey reports for the project. Based on evidence from comparable geographical and depositional situations, for example the James River area, it is highly probable that buried sites exist on the floor of the Souris River Valley, and that such subsurface testing of areas with high potential for containing cultural resource sites will produce identifications of sites which were not located during the surface inspections.

Corps Responses to the North Dakota State Historical Society Comments

1. See paragraphs 2.173 to 2.179. Your comments regarding subsurface testing for buried sites have been incorporated into the text, and will be implemented during future investigations.

Dill to Banks
page 2.

2 2. In paragraphs 2.174, 2.175 and 4.83, reference is made to a Hidatsa occupation of and possibly a Hidatsa village on the Souris River floodplain near Minot, North Dakota. Referring back to the draft of "Preliminary Cultural Resource Investigation of the Upper Souris River Basin, North Dakota" (Schneider 1977), and cross checking the bibleographic references for this data, *we find no evidence that* LaVerendrye visited a Hidatsa village *on the Souris. The references* quoted in Schneider's paper appear to relate to a group of Assiniboin Indians, not Hidatsa. Although it is entirely possible that the Hidatsa used or occupied the Souris River Valley *during the period in question*, we know of no reliable reference to a Hidatsa site being identified or suggested on the Souris River floodplain.

Thank you for your consideration of these comments.

Sincerely,

James E. Sperry
State Historic *Preservation Officer*
(North Dakota)

C. L. Dill
Survey Archeologist

cc: Schneider, U.N.D.
Calton, U.S.C.E.

Corps Responses to the North Dakota State Historical Society Comments

2. The requested change has been made. See paragraphs 2.187 and 2.188.

November 22, 1977

Mr. J. R. Calton, Chief
Planning Branch, Engineering Division
Department of the Army
1135 U.S. Post Office & Custom House
St. Paul, MN 55101

Dear Mr. Calton:

We have reviewed your Draft Environmental Impact Statement and Design Memorandum No. 2, (Phase I - Plan Formulation) *Flood Control* Burlington Dam, Souris River, North Dakota. We offer the following comments:

According to Section 4.77, P. 104, Grano Fishing & Recreation Area would be periodically inundated and would require temporary removal of picnicking facilities and require clean-up operations after flooding.

Grano Recreation Area was developed with 50 percent federal Land & Water Conservation Funds in 1967. Section 6(f) of the Act authorizing the funds *would likely apply here as recreation days would be lost during flooding and* clean-up.

1. "No property acquired or developed with assistance under this section shall, without the approval of the Secretary, be converted to other than public outdoor recreation uses. The Secretary shall approve such conversion only if he finds it to be in accord with the then existing comprehensive statewide *outdoor recreation plan* and only upon such conditions as he deems necessary to assure the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location."

The project was sponsored by the Renville County Park Board and the total cost was $24,435. This money was used to construct a comfort station, boat dock, ramp, parking lot, camping and picnicking facilities, wells, pumps and to plant trees and do landscaping. Any damage to any of these developments would constitute a violation of Section 6(f).

[illegible]rps Response to North Dakota State [illegible] Recreation
Agency Comments

1. See letter from Bureau of Outdoor Recreation, 22 December [illegible], and Corps response.

2. The fishing area downstream from Lake Darling Dam (west side) would be eliminated with movement of dam outlets to the east side. We assume any recreation developments would be relocated to prevent recreation day losses due to flooding.

This agency cannot support any project which would destroy native forest - especially of so many acres (900). Trees make up just two percent of North Dakota's surface area, a percent which is decreasing yearly.

We thank you for the opportunity to review your Draft E.I.S. and hope that our comments will be followed up on.

Sincerely,

Karen F. Thompson
Recreation Planner

KFT/kmm

Corps Responses to North Dakota State Outdoor Recreation
Agency Comments

2. The fishing area referred to is not on the west side but on the east side below the spillway of Lake Darling. This small area containing an access road, parking lot and picnic tables may be adversely affected by the new structure proposed at Lake Darling dam. Accordingly, when the design work for the structure has been completed, during the project design phase further coordination will be conducted with the FWS to determine the need for mitigating measures. Such measures, if found necessary, will be provided for at project expense.

NORTH DAKOTA
STATE WATER COMMISSION
900 east boulevard bismarck 58505
701-224-2750 north dakota

November 29, 1977

Colonel Forrest T. Gay, III
District Engineer
U. S. Army Corps of Engineers
St. Paul District
1135 U. S. Post Office and Custom House
St. Paul, Minnesota 55101

RE: SWC Project #1408

Dear Colonel Gay:

This is in response to your October 26, 1977 letter requesting comments on the draft Phase I General Design Memorandum (Design Memorandum No. 2) and Environmental Impact Statement on the Burlington Dam flood control project, Souris River, North Dakota.

On November 2, 1977, Roger Fast, Bob Stenfors, and Dave Loss of your staff along with two engineers from this office met with the McHenry County Commissioners in Towner, North Dakota. The purpose of that meeting was to explain the Burlington Dam project's new additions and the plan of operation for flood water discharge.

1. A well planned program for regulation of releases from the reservoir will be necessary to accommodate the concerns of the downstream landowners. Concern was expressed at the meeting by area farmers that a summer release rate of 500 cfs would keep portions of their fields inundated throughout the summer causing loss of production in these areas. It appears that the farmers in the downstream areas of Burlington Dam would be less affected if the plan of operation could be modified so that flood water releases would be made after farmers have harvested their crops. At this time, the release rates could probably be increased over 500 cfs if necessary to draw down the flood water storage behind the dam. I believe that this is an alternative that should be explored and addressed in the Phase I General Design Memorandum.

I do believe that all alternatives have been adequately exploited and the project as proposed along with the present additions meets with the approval of a great majority of the affected citizens. These additions I feel will enhance the idea of comprehensive flood control for the valley.

[illegible]

1. [illegible] lands [illegible] the [illegible] that would [illegible] the pro- [illegible] reservoir release rate [illegible] the summer grow- [illegible] are about [illegible] acres of hay lands located between Towner, North Dakota, and the south boundary of the [illegible] Refuge. The recommended plan provides for the acquisition of flowage easements on these lands to compensate the owners for [illegible] that would be sustained during those years when a 500 cfs summer release rate is necessary to empty the reservoir. The proposed reservoir operation plan was developed with the [illegible] of minimizing adverse impacts both above and below the dam. To reduce the reservoir emptying rate below 500 cfs would require that storage be prolonged above the dam and would thereby cause further adverse impacts on farm and refuge lands above the dam. The Fish and Wildlife Service has indicated that a release rate below 500 cfs is unacceptable in view of the increased adverse impacts on Upper Souris Refuge lands.

In summary, I believe the long term benefits of this project will offset adverse impacts upon the land and the people in the area. The State Water Commission has previously stated their support for comprehensive flood control for the valley and continues to do so.

Sincerely yours,

Vernon Fahy
State Engineer

VF:BB:dm

NDSIC FORM 8 (9/71)

PNRC No. 77-567

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58501

ENVIRONMENTAL IMPACT STATEMENT TO BE REVIEWED

TO: Mr. Larry Vetter, City Planner
Minot Civic Center
Minot, ND 58701

ISSUED BY: Corps of Engineers

DATE: November 8, 1977

NAME OF PROJECT: Draft EIS & Design Memorandum No. 2, (Phase 1 - Plan Formulation) Flood Control Burlington Dam, Souris River, North Dakota

RECEIVED NOV 21 1977

The attached Environmental Impact Statement is referred to your agency for review and possible comments. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check one of the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse within 10 days from date of receipt. If no response is received within 15 days of date of notification it will be assumed you have no comment.

- [ ] No comment
- [x] Comments submitted herewith
- [ ] Meeting desired with applicant

1. Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use reverse side or separate sheets if necessary)

2. Reasons why meeting is desired with applicant:

Reviewer's Signature: L. C. Vetter Jr. Date: ______

Title: ______ Tele: ______

D-II-56

The following letter and resolution were ... the proposed project from the City of Minot.

city of minot

PLANNING DEPARTMENT

November 16, 1977

Bonnie Banks, Associate Planner
North Dakota State Planning Division
State Capitol, Ninth Flloor
Bismarck, North Dakota 58505

Dear Bonnie:

In regard to your requests for any comments that I might have concerning the Draft EIS and Design Memo No. 2 Flood Control Burlington Dam, I have enclosed comments that I have made at a Corps of Engineer public hearing. These are the only comments I have at this time.

Sincerely,

Larry C. Vetter
City Planner

LCV/ddh

Enclosure

D-II-57

minot civic center / minot, north dakota 58701 / (701) 852-4041

In discussions regarding flood control for the City of Minot, one immediately wonders how other cities have responded in facing similar situations. Attempts have been made to catalog other flooding problems where studies have been prepared, and particularly where the alternative of flood plain evacuation either has been implemented or likely will be implemented.

Information concerning four other communities is readily available. They are as follows:

(1) Kingery West, Illinois
This community consists of 4,000 people, and 80 homes were in the flood plain. Costs of evacuation were $3.5 million.

(2) Prairie du Chien Wisconsin
This town lies along the Mississippi River, has a population of 5,540, and 124 structures lie in the flood plain. Costs for flood plain evacuation and flood proofing amount to $3,300,000.

(3) Baytown, Texas
This is a city of 44,000 people lying along the Texas coast near Houston. It has been subject to flooding due to land subsidence caused by oil and water wells pumping both fluids from the ground. A total of 448 homes were in the "flood plain," and evacuation cost estimates were $17 million.

(4) Rapid City, South Dakota
As most of us know, Rapid City suffered a devastating flash flood in June, 1972. Their city has a population of about 44,000, and 1200 homes were affected. This is probably the largest example of Federal-local cooperation in a flood plain evacuation program and merits close attention. Costs for evacuation ran to $84 million, of which $16 million was the local share.

It would be important to note that the Corps of Engineers determined that additional flood control structures including channel modifications within the city were not feasible, and given local hydrology, the city is subject to flash flooding. A study of building conditions after the flood indicated that 50 percent of the buildings in the flood damage area sustained major damage or total destruction. It was also determined that these buildings which endured the flood could not likely endure future floods.

Additionally, the flood plain in Rapid City is
relatively narrow; it is only four blocks wide
in the central business area.

After this brief review, it is obvious that a comparison with the first three cities to Minot is not realistic as the combined total of structures affected come to only about 17 percent of the total structures affected in Minot. Therefore the only real comparison is with Rapid City.

First: Total homes affected =
Rapid City had 1,200; Minot, 3,500

Second: Total estimated costs =
Rapid City: $84 million total
$16 million local
Minot: (for evacuation) $100 million total
$ 37 million local

Third: Width of flood plain =
Minot's flood plain is roughly twice as wide as Rapid City's.

Fourth: Subject to flash flooding =
Rapid City is subject to this condition to a much greater degree than Minot.

Fifth: Building Conditions =
Rapid City's buildings in the flood damage area suffered such great destruction (over 50 percent received either total or major damage) that the situation made flood plain evacuation much more feasible. Minot has not suffered this type of disaster.

In addition to the quoted figures in the Environmental Impact Statement indicating the number of homes, businesses, churches, and schools lying in the flood plain, there is one additional factor that should be considered. That is a measure of Minot's cultural heritage that is located in the valley. The one North Dakota consultant who is qualified to survey buildings for their architecturally historic significance, conducted a "windshield" survey to identify these buildings in Minot. While admittedly, the survey was only accomplished from a vehicle and not by an in depth analysis, the results indicated that 78 percent of Minot's architecturally historic buildings lie in the flood plain.

Obviously, the situation in Minot concerning flood control is unique, as it is unique in every other city facing this situation. Therefore the solutions must be tailor made for each situation. But one factor stands forth as necessary. That is that a total flood plain management program be implemented. This involves flood plain zoning, participation in the flood insurance program, and the construction of structural remedies, namely channel improvements and the construction of the dam. Minot has flood plain zoning. It is a participant in the flood insurance

program, with 3,281 flood insurance policies in effect for $68.911 in coverage, and is nearing completion of the channel improvements. This leaves only one additional item in order that proper utilization and protection of the valley occur. And that is construction of the dam.

Flood plain evacuation not only does not consider the total community wide effects of the relocation of 3,500 homes, over 200 businesses, 9 schools including one college, and 15 churches, but it also does not consider where this city will find the $37 million in local costs for our share in a $200 million evacuation program. Additionally, evacuation has not been adequately studied to measure the full costs: costs, for example, of maintaining or sealing off utility lines, street lights, water meters, and new pressures on different utility lines and streets in areas surrounding this city where relocations would occur.

Therefore as previously indicated in this statement Minot has only one alternative in establishing a good flood plain management program. We have accomplished three-fourths of that alternative, flood plain zoning, flood insurance, and channel improvements, but the final portion needs to be completed to realize our objective. That is that structural protection should be accomplished by construction of the dam.

Larry C. Vetter
Larry C. Vetter
City Planner
City of Minot

A RESOLUTION

WHEREAS, the representatives of the Corps of Engineers have presented a revised flood control project for the Souris River as set forth in Draft Design Memorandum #2 and the Draft Environmental Impact Statement which includes a number of beneficial changes in the initially announced plans; and

WHEREAS, these changes will not only improve flood protection offered by the project but also greatly expand its benefits to the people in the Souris Valley; and

WHEREAS, the project alterations and improvements are directed at minimizing hardships and disruption in connection with the project, thus charting a course of action relating to people that lends itself to further pursuit;

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Minot in session convened this 21st Day of November, 1977, that the Corps of Engineers is hereby commended for the people-oriented changes it has made in the flood control project, and

BE IT FURTHER RESOLVED that this body urge consideration to

(1) using the most flexible standards possible to provide the greatest number of crossings of the flood plain in Renville County,

(2) use every means to alleviate the loss of tax base and make the largest possible payments in lieu of lost taxes to affected subdivisions,

(3) forego taking of lands in Renville County, by either the Corps of Engineers or the fish and wildlife services, other than those lands directly connected with the building and operation of the flood control project,

(4) giving those people who will be asked to sell lands or accept flowage easements the greatest possible advance notice of affected lands and the amount of payment to be made,

(5) establishing a local citizen entity whose function it would be to work out problems and lessen disruptions that might occur in connection

City of Minot

with building or operating the flood control project.

BE IT FURTHER RESOLVED that the City of Minot pledge its support to help, in any way feasible, to maximize flood protection and resolve rural and urban concerns or inequities.

Passed and Adopted this 21st day of November, 1977.

Chester Reiten, Mayor

ATTEST:

Joan Engelhard
City Auditor

City of Minot

The following 7 letters of comment express general opposition to the construction of the proposed Burlington Dam. These letters will be taken into consideration in the decision making process.

Dec 9, 1977

Chief Engineering Division

Dear

In regard to the maps you sent. After studying them I find myself more convinced than ever that there will be more impact than you are ... to the residence I feel there ... the appearances of having ... this particular farm we ... Last twenty five years ... having lived in this area ...

I know that with the area ... shaded on the map have ... then there will be more ... the land affected. I also ... way that we will be able to ... on the farmstead we live. ... by the shaded area you ... it goes right around my farmstead. It has to increase the chances of flooding more often. It ... it impossible to live and

(2)

and maintain a farm opperation

I don't understand that in the Souris valley you are proposing doing something for all residences including 110 extra or whatever the figure is, yet in the Des Lacs Valley you seem to feel you need do nothing or as little as possible.

It seems odd to me that the first contact I had with you people was a real estate representative who stopped to talk about what would happen in regard to relocating our farmstead if this project went in. Yet now you seem to be saying that you will be needing to back water right around our farmstead but leave us sat.

I have never been able to understand how you intend to pass all the old trees, ice slops etc that come down the Des Lacs river in the spring of the year through the tunnel or dam without jamming and causing backwater effects every year

(3)

I can't believe that you people have any idea the worry that this project has caused to my family and myself over the years. the worry of flooding each spring along with knowing what will happen to our farm if this project goes in like the worry it caused my wifes folks who passed away within the last year and a half. they lived in the home which my oldest son and his family live in now. that is the place right down by the iron structures in the slides.

I truly believe that you are wrong in your idea of back water effects. Anytime there is any kind of a structure or tunnel or whatever to pass water, ice etc through you have worsened our flooding on my property on both places we farm on our land. Also increased the chances of it happening more often. After all we have flooding there now.

(4)

I certainly hope that the diversion tunnel will be elimated as is being said will happen. You yourself admit it can't be justified as far as cost benifit ratio goes. I believe it would be an injustice to the people of our entire Des Lacs Valley inregard to the chances of ever getting something done for our entire Valley. We too have flooding problems and would like to have our problems considered to.

As I have said I offer the ideas I have expressed different times based on the fact that I have lived here all my life and feel I have learned from experience during flooding years

Sincerely
Donald Stieg

[illegible]
Nov 2[illegible], 19[illegible]

[illegible]
[illegible]
[illegible] 35 U.S. Post Office & Custom H[illegible]
St. Paul, Minn. 55101

Dear Sir—

[illegible] are very much opposed to the construction of Burlington [illegible]

[illegible]

[illegible] tall grass which [illegible] grasshopp[illegible] and [illegible]

[illegible]

Mr [illegible]
Rt. [illegible]
587[illegible]

Mr. & Mrs. Clair O. Southam

Mohall, North Dakota 58761

Dec. 16, 1977.

Department of the Army
St Paul District, Corps of Engineers
1135 - U.S. Post Office & Custom House
St Paul, Minn. 55101

Gentlemen:

We have reviewed the Draft Environmental Impact Statement on the Burlington Dam and Reservoir, North Dakota.

We feel that the draft is incomplete in the discussion of Burlington Dam and Reservoir as the selected alternative, [illegible] that this might be economic damage to local governmental units upstream from Burlington. There will be detrimental effects to these units from the Burlington Reservoir, and the raising of Lake Darling Dam. These detrimental effects will be less in the event that a minimum acreage will be purchased in fee, inasmuch as the amount of taking in fee increases. To serve the purpose for which it is

Mr. & Mrs. Clair O. Southam
Mohall, North Dakota 58761

[illegible] the impact statement should [illegible] but in some detail the manner [illegible]. It is not sufficient to say that the amount to be purchased [illegible] determined [illegible] the statement should [illegible] exist [illegible] situations.

The impact statement should [illegible] might [illegible] reading in [illegible] to move from the [illegible] districts. [illegible] school districts adversely. [illegible] would appear that these [illegible] consolidating form the basis for legal action to force [illegible] re-writing and re-submission of the impact statement

Very truly yours,
Mr & Mrs Clair O. Southam

HOUSE CHAMBER

Forty-fifth Legislative Assembly

STATE OF NORTH DAKOTA

BISMARCK 58505

Rep. Larry Herslip
District 6
Souris, ND 58783

Committees
State & Federal Government
Agriculture
Veterans Affairs

Dept. of the Army
St Paul Dist. Corps of Engineers
1135 U S Post Office + Custom House
St Paul, Minn 55101

Dear Sir:

As a state legislator and a concerned citizen I would appreciate your consideration on re-evaluating the proposed Souris River Basin Flood project.

The Corps of Engineers does have alternative plan which I am sure would have a less adverse effect on our community.

Respectfully

Larry Herslip

BOTTINEAU-

CHAMBER OF COMMERCE

- North Dakota 58318

"BUILDING A BETTER COMMUNITY"

16 December, 1977

Colonel Forrest T. Gay, III
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Everyone is vitally concerned about recent development in the proposed Burlington Dam project at Minot.

The Bottineau Chamber of Commerce passed the enclosed resolution.

We fully realize that flood protection for Minot is important, but it must be carried out to give maximum protection to everyone in this area.

Crop losses, to blackbirds and ducks, has been unbelievable, many different years, in Bottineau County. A survey of sunflower growers showed a $300,000 loss to blackbirds. This is to say nothing of the acres of small grain which they damaged.

Bottineau Co. contribution to the wildlife program has been as follows:

152,490 acres in the perpetual easement program.
26,186 acres owned by the U.S. Wildlife Service.
14,233 acres in the Waterbank Program.
9,755 acres in the State Forest Preserve.
Clark Salyer Refuge pays .98¢ per acre for taxes. Most farm land pays $1.80 to $2.25 per acre.

In addition, there are thousands of acres of sloughs, which are not drained, plus field margins and road ditches which are left for wildlife.

In the impact statement, they had never considered the Willow City watershed problem which adds a tremendous amount of water to the Mouse River.

We ask that you look at all angles, plus visit with more people, before

Visit The Turtle Mountains — Lake Metigoshe — International Peace Garden

the go ahead signal is given on any flood control program and wildlife acquisition program.

Sincerely,

Roger Nelson

Roger Nelson, President
Bottineau Chamber of Commerce

enclosure

cc. Chairman
Council on Environmental Quality
722 Jackson Place, N.W.
Washington, D.C. 20006

Mr. Orlin Hanson, Chairman
Citizens United to Save the Valley
Mohall, North Dakota 58761

Mr. Russell Stuart
Commissioner
North Dakota Game and Fish Department
Bismarck, North Dakota 58505

Harold Refling moved that the Chamber adopt the following resolution:

BURLINGTON DAM AND PROPOSED
WILDLIFE ACQUISITION

Resolved that the Chamber of Commerce of Bottineau go on record as being opposed to the Burlington Dam because it will not alleviate flooding in areas above or below Minot without channelization. There is presently in progress a Canadian Souris River Basin International Involvement group promoting cooperation between Canada and the U.S. We commend these groups for their leadership and feel that the proponents of the Burlington Dam should recognize their accomplishments and give consideration to the alternatives suggested.

Furthermore, in the event that Burlington Dam were to become a reality, the U.S. Fish and Wildlife Service has designated 5,160 acres, in Bottineau County, as acreage from which they would select a portion to replace acreage adversely affected elsewhere by the construction of Burlington Dam. We vigorously oppose this land acquisition program because it would continue to erode our tax base, disrupt farming operations, increase our blackbird and waterfowl depredations, and weed control problems, plus grasshopper problems, from time-to-time.

Second by Walter Erdman. Carried unanimously.

Dated November 14, 1977

OFFICERS
ESTHER HOCHSPRUNG, COUNTY AUDITOR
RUTH N. BASKA, COUNTY TREASURER
ROBERT E. REISER, REGISTER OF DEEDS, COUNTY JUDGE AND EX-OFFICIO CLERK OF DISTRICT COURT
JOAN A. OTTO, SUPERINTENDENT OF SCHOOLS
DAVID FITZGERALD, SHERIFF
ERWIN H. BRENGEL, STATE'S ATTORNEY
JAMES A. RODACKER, DIR. OF TAX EQUALIZATION

RENVILLE COUNTY
NORTH DAKOTA
MOHALL
58761

COMMISSIONERS
FIRST DISTRICT
DONALD F. HANSON, SHERWOOD
SECOND DISTRICT
DONN W. LUEBKE, MOHALL
THIRD DISTRICT
LESTER RHOADS, GLENBURN

December 14, 1977

Colonel Forrest T. Gay III
District Engineer, Corps of Engineers
1135 U. S. Post Office and Custom House
St. Paul, Minnesota 55101

Re: Burlington Dam

Dear Colonel Gay:

The Board of County Commissioners of Renville County, North Dakota, has asked me to write to you regarding the proposed Burlington Dam Project and to reiterate the Board's position, and we believe the position of an overwhelming majority of the residents of the county, insofar as the project is concerned. Needless to say, the controversy over Burlington Dam has raged for more than two decades and no doubt, your files and those of all other agencies concerned with the project are full of data and material concerning same. Nevertheless, we feel that it is fitting to once again, for the records, and for your information and that of others concerned, summarize and reiterate our position.

Renville County is a small county, consisting of twenty-four congressional townships, but a county which has since its establishment in 1911, been considered one of the better farming counties in the state. *This is due largely to the fact that we are* situated in what is known as the Mouse River Loop which contains much good, level, fertile farmland. Our population is industrious and enlightened, and we have had good, businesslike fiscal management in our county government which has resulted in being able to pay our own way over the years, without the "financial emergencies" "crises" which other counties have suffered.

Over the years, starting in the early 30's, various government agencies, principally the Fish and Wildlife Service, have acquired land in the county, and we now estimate that 21.49% of all the county land is either owned or leased by the Fish and Wildlife Service and other agencies. This has, of necessity, reduced our tax base and to some extent, our population. Nevertheless, we have managed to be fiscally sound and to contribute our share to the state and national economy in general and food supply in particular. Within the past twenty years there has been developed within the county a healthy oil production industry which has contributed substantially to the petroleum needs of the state and nation.

However, there has, for more than two decades, hung over our heads the constant threat of the so-called Burlington Dam Project, sponsored principally by the City of Minot and promoted by the Corps of Engineers, which could very well [illegible] our viability as an economic and political unit, all in the name of [illegible] the flood threat of the Mouse River to the City of Minot. None of this [illegible] you, but we desire to reiterate our unconditional and continuing opposition to the Burlington Dam Project, in part for the following reasons:

1. Construction of the project would strike a crippling if not fatal blow to the economic, cultural and political existence of the County, including displacement of farm families, loss of prime farm land, loss of tax base, which in turn will bring about decline of school population, fire department services, and county government in general. All taxing entities will suffer not for just a short time, but indefinitely.

2. The project will bring about the loss of the Mouse River Park, together with numerous recreation facilities and ruin the fishing on the Mouse River and Lake Darling during periods of high water and following same. Much of the Mouse River valley will be ruined, never to be replaced and the picnic and recreational facilities at Grano Recreation Area will have to be temporarily or permanently removed.

3. The Grano Crossing, which accomodates approximately 300 cars per day will be inundated as much as seven months of the year and the receding of the waters will leave the roads unusable and no provision has been made for repair and rebuilding such roads, and presumably the load will fall upon the county.

4. Judging from past experience, even temporary flooding of the valley will result in the destruction of trees, grasses and other vegetation, and result in the appearance of undesirable plant growth such as cattails and bind weed, making the land to a great extent unusable for agricultural purposes and attracting, in addition thereto, numerous pests such as blackbirds, which will constitute an expensive nuisance to neighboring farm lands.

5. The McKinney Cemetery, which is the burial place of many of the old pioneers, and which is still used for burial purposes, will be inundated and destroyed.

6. The Mouse River Park which now contains approximately 82 cottages plus recreational and service facilities such as meeting halls, restaurant, bar and lounge, roller rink and other gathering places, will be destroyed.

7. It is our understanding that the crossings on the Mouse River will be reduced from the present nine to four. Needless to say, this will also seriously affect our economic condition, making it very difficult if not impossible, to bus children to the schools in the districts in which they belong and, if bussing should continue, making the process extremely expensive. It would result, for all practical purposes, in cutting the county in two with very little transportation and communication between the two halves. We have also been advised that the Fish and Wildlife Service proposes to acquire a vast amount of so-called "mitigated land" to compensate for their losses as a result of the Burlington Dam. If this acquisition is carried through, it will of course have a tremendous negative effect upon the economy of the area. This, in addition to the proposed 7,000 acres for purchases in fee plus acquisitions of additional thousands of acres acquired as "uneconomic remnants" is unacceptable.

We urge you and the Corps of Engineers to again reconsider all the factors involved in this proposed project and upon balancing them, we are confident that you will find that the bad points far outweigh the good ones, if there are any, other than to a small extent alleviating flood threats to the City of Minot. We are constant

December 14, 1977

in our belief that an alternate wav can be found to protect Minot without destroying us.

Very truly yours,

RENVILLE COUNTY BOARD OF COMMISSIONERS

By Donald F Hanson

Donald F. Hanson, Chairman

Rural Route 2
Lansford, ND 58750
December 8, 1977

To:
Governor Arthur Link
Honorable Mark Andrews
Senator Milton R. Young
Senator Quentin N. Burdick
Colonel Forrest T. Gay, III

Dear Sirs:

We are writing this letter concerning the Burlington Dam and the acquisition of extra acres for wildlife purposes. We would like your help in stopping this disaster from happening to our North Dakota farm land.

If the wildlife buys this land it takes it away for ever and our children and their children never have a chance to farm it. In the proposed acres we have 160 acres listed; with todays prices and economic situation this would make the difference if we continue to farm or sell out.

It would also erode the tax base, create areas where weeds are a major problem, plus grasshoppers from time to time, along with making a haven for blackbirds and ducks.

We the American Farms are losing thousands of acres each day to urban areas, roads, wildlife, and recreational areas. If this keeps up at the pace it is who will feed the world in the furture.

Please help to stop the loss of this beautiful valley and prime farm land in our state. It will affect every person in the world.

We believe that there are alternatives in the environmental impact statement, such as a tunnel under Minot that would provide protection for them and not hurt or violate any of the people of this GREAT STATE.

Put yourself in the situation of having to move off the farm your ancestors homesteaded on. Thank you.

Sincerely,
Mark Adams
Julie Adams
Mark and Julie Adams
(a young North Dakota farm family)

Enclosure: resolution

The following resolution was unanimously passed at the North Dakota Township Officers Association Annual Meeting in Devils Lake N.D., Dec. 1, 1977.

The North Dakota Township Officers Association goes on record opposing any other acquisition or mitigation of prime land by the Corps of Engineers or the Fish and Wildlife Service.

These acquisitions effect every farmer and tax payer in the state by eroding the tax base, creating areas where weeds are a major problem plus grasshoppers from time to time along with making a haven for blackbirds and ducks which erode the production of adjoining cropland.

Mark Adams, Chairman
Board of Supervisors
Blain township
Bottineau, County
Lansford, ND 58750

The following [illegible] letters [illegible] in sup[illegible] environmental quality (EQ) plan and opp[illegible] earlier [illegible]. In addition many of the letters adv[illegible] flood [illegible] measures in Saskatchewan. The supp[illegible] for the EQ plan will be taken into [illegible] process.

CITIZENS UNITED TO SAVE THE VALLEYS
Ward, Renville, McHenry Counties
Mohall, N. Dak. 58761
December 14, 1977

Department of the Army
St. Paul District, Corps of Engineers
[illegible] U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Gentlemen:

Enclosed is an article on the front page of the 12/14/77 issue of The Renville County Farmer, quoting Governor Link as stating new factors have come to his attention such as increased opposition of the Burlington Dam Project. In light of these new factors, he feels there should be a re-examination of this Flood Control Project and a good new look at some alternatives and benefits derived from these.

In view of Governor Link's concern, at this time we feel it is important that you re-examine your position on this matter and consider the alternatives to this Flood Control Project. One of these alternatives is Alternative 15 or the Environmental Quality Plan as proposed by the Corps of Engineers.

This plan will give almost protection from 100 year flood and would better serve the needs of all the people residing in the Souris River Basin. There would be very little disturbance of the valley as it is today and there would be no land mitigation needed due to environmental losses.

We urgently ask your consideration of this matter at your earliest convenience.

Sincerely,

Orlin M. Hanson

Orlin M. Hanson
Co-Chairman
Citizens United to Save the Valleys

Enclosure
OMH/bms

Governor Link Calls For Good Look At Dam

Governor Arthur Link said this week of Burlington Dam, "Seeing that there are other factors, I didn't know about, if those things change I've got a right to take another look. The opposition and lack of unanimity has increased in the last few months. I thought it was pretty much resolved."

When asked if he was in favor of the Burlington Dam Project, as it now stood, Link went on to say, "I would want to re-evaluate any proposals in the making and take a good new look at alternatives and benefits coming from them."

Link stressed "new factors" in the case - such as vocalization of opposition to the dam by farmers as influencing his decision to re-examine the Burlington Dam.

The Governor stresses that he was in favor of flood control for Minot providing the plan provided the maximum amount of protection with the least amount of discomfort.

But not all officials felt that way. Senator Quentin Burdick said, "The devastating floods of recent years have demonstrated the need for flood protection for the city of Minot and those of the Souris River Valley. The Congress of the United States have already authorized such protective works and I trust such projects will go forward without delay. I shall make every effort to see every landowner is fully compensated for his contribution."

An aide at the Senator's office said that this was the message the Senator generally used for the project. And that the Senator had long supported the dam.

But Congressman Mark Andrews said, "As a farmer myself I can understand why people would be upset. I'm for whatever people from the local areas can come up with and having it resolved at the local level by the State Water Commission."

Andrews said, "I don't see any reason not to give some consideration to the number of acres in other places." The Congressman wondered if some of the mitigated land couldn't be taken further away from the dam site if it came to that.

Andrews said, "The U.S. Fish and Wildlife Service should be kept on a little shorter string."

Andrews also took the position that he is for flood control for Minot but is looking for the best plan for the large amount of people that adversely affects the smallest number of people.

The only person or group that seems specifically in favor of the Burlington Dam is the Mayor of Minot, Chester Reiten said, speaking for the Minot City Council. "We're in favor of Burlington, the council is unanimous in favor of the dam."

Reiten said he was not aware that Army Corps of Engineers had not worked several factors into their cost -benefit ratio, such as bird deprivation and hunting losses."

The mayor said they had supported the dam since about 197[illegible] [illegible] and the proposed alternative, a tunnel under Minot was not completely viable. It doesn't protect us against a main flood and doesn't protect Minot."

But the Mayor was aware that the Burlington Dam proposal would leave Minot open to flooding from the Gasman [illegible]. The reasoning behind leaving the Gasman Coulee open is one of the reasons behind the Burlington Dam probability analysis.

Basically the Corps has estimated that the Burlington Dam will protect Minot from flood for 240 years. The Minot tunnel alone will give 100 year protection and the entire Burlington Dam complex along with a proposed Gasman Coulee dam would give 1,100 years protection.

However the figures are based entirely on mathematical calculation. Minot is situated on the 100 year flood plane and should only flood every 100 years by mathematical probability.

However Minot has flooded three times since 1969 showing the speculative figures are less than accurate in projecting actual conditions. It also seems unreasonable to build the Burlington Dam and leave the Gasman Coulee open when a strip of land expected only to flood only every 100 years floods three times in eight years.

Dissension in Minot was heard in the voice of Albert Rusty) Kouba who is on the Minot City Council. Kouba says he did not vote against flood control for Minot. Originally Kouba voted against the dam, but has now changed his vote to support the dam at the request of his constituents. Kouba said, "I don't like all the deception and lies that are put on by the Corps. They did help us in flood control, now they have started playing God. I am in favor of flood control. I believe the Corps has not been honest or fair."

Kouba gave several examples of what he considered to be poor conduct by the Corps. One revolved around the Corp's flood manager Jim Ruyak. Kouba claimed Ruyak told members of the Minot media several years ago that in his Ruyak's opinion, the Burlington Dam would never be built. Kouba says Ruyak told reporters he would deny the statement if he saw it in print.

Once called at the St. Paul office Ruyak said, "I may have voiced apprehension at the general public's attitude toward the dam, the more popular forms of flood control are not structures."

Ruyak said that for every dam now under consideration by the Corps, the public would feel the same way.

Ruyak also stated the Corps' official position which is that the Burlington Dam is the most effective source of flood control in the Souris River Valley.

Kouba said he was personally opposed to the Burlington Dam and felt it was being built for alterior motives. It's being built to provide jobs to help the economy and promote enterprise. It even says in the impact statement that the tunnel under Minot would provide more jobs than the dam.

"The dam means money and the people who run this town, the lawyers, the architects and the contractors want it so bad." Kouba said.

"We've got to take the politics out of this, there is too much emphasizes on Burlington Dam for the economy."

Kouba raises serious questions around the cost - benefit ratio for the Burlington Dam. The benefit listed as in the design memorandum for the project all occur in Minot or below the dam.

The costs would be sustained by the area near the dam and four counties listed for mitigation.

However, many factors were not taken into account. The Corps made estimates of tax base loss but did not put them into the cost - benefit ratio for the dam. The Corps did not consider the loss of over $30,000.00 in bird deprivation to Bottineau County alone last year. With the four counties listed for possible mitigation and undoubtedly greater bird deprivation there will be over one million dollars of loss not computed in ratio.

The Corps has also claimed at various times that one county or another may not be affected by mitigation. Renville and Bottineau Counties have been mentioned by members of the St. Paul office of the Corps as being excepted from mitigation, perhaps in an attempt to lessen opposition to the dam.

The one constant problem with the Burlington Dam according to most opponents is that a complete study is needed of the Souris River above and below the Canadian border.

Orlin Hanson, Chairperson of the Citizens United to Save the Valley, a private group to oppose Burlington, recently distributed a letter to members listing their reasons for opposition.

No. two on their list was the fact that not building the dam will save Souris River Valley, yet the Army Corps of Engineers feels the Burlington Dam is the best solution for flood control in the Souris River Valley even though the dam will destroy the valley as it now stands.

"It's time to treat it as one problem," Hanson said.

"One of water control management, it's time Minot took a look at the future, not just the immediate years. The tunnel will give them more employment than the dam. We are not just looking at water supply, it's everything within one gigantic picture for the future."

Hanson pointed out the water from the Souris River flows back into Canada cleaner than when it comes in and encouraged working with Saskatchewan and Manitoba provinces.

Warren Brown, chairman of the Bottinueau County Commissioners said of the situation, "We passed a resolution against it saying we would follow Renville & McHenry counties if they took action. We're against Fish and Wildlife getting more acreage. No one is sure who it's going to be or who is going to lose. I can't see where it does Bottineau County any good. Why should we give up land to help Minot. Anytime they want to get flood control they take it out on the rural people. The only ones that are going to get any good out of it is Minot. I don't think they've looked at other plans. It could cause a lot of damage on the Souris River. They never looked into Willow Creek. They haven't studied the consequences at the other end of it.

A farmer near Newburg, Sherman Welstad and his son, Blaine were listed for "7 or 8 quarters" for possible mitigation by the Fish and Wildlife Service.

They're on natural drains, have been here long before man got here - same chance of flooding as in Minot. It's private land and they want to control it. They seem to feel they are superior over everything, virtually all of them. I feel like it's just bugging them, like they made a list to get even. I get the feeling the Fish and Wildlife want some or all the land, they're ambitious. They got plans. They never give up anything, but they sure like to add. They act sympathetic but just feel it's your tough luck."

Another farmer Elmer Zurcher, also of Newburg said, "I feel like all the rest of us between the two refuges. There's been enough sacrifice. Taking away a quarter may make the difference between making it or not making it for a growing farmer. Destroying the valley is the next thing to a crime. We will stand behind the people in the west and stand behind them to the last ditch."

Larry Herslip, 6th Dist. Representative from Bottineau County, said, "We definitely need flood control and water management. It is also quite evident that there are alternative ways to accomplish this with less adverse effect on the community. I feel it to be in the best interest of this area that we oppose construction of the Burlington Dam and support some alternative method which could prove to be more beneficial to all concerned."

State Senator Walter Erdman said, "Allow me to emphasize the fact that the Citizens United to Save the Valley or myself are not opposed to flood control for Minot. However we are opposed to the present plan as proposed by the Corps of Engineers because of its adverse effects on our area. There are alternatives!

It appears unduly, unreasonable to me that the four area counties namely, Bottineau, McHenry, Renville and Ward after having contributed so generously to the Fish and Wildlife programs in the past should be required to sacrifice additional acreage."

Surrey North Dakota
December 13, 1977

Department of the Army
St Paul Dist. Corps of Engineers
1135 U.S. Post Office & Custom House
St Paul Minnesota 55101

Dear Sirs:

In regard to the Burlington dam I think plan 15 is a good plan. (Environmental Quality plan)

If the people would get together and control the small streams that flow into the Mouse river in U.S. and Canada it would help so that Burlington dam and the alternative 15 will not be needed.

They have done a good job already improving the river going through Minot and more can be done.

When I say to control the small streams I do not mean to make dams - I mean to slow the water down by using blocking Culverts, then when the high water has gone by these can be opened and let go.

As for Wild Life, I think they do a very poor job. I have seen them burn off grass about 20th of May when the birds are nesting. They have a refuge 2 Miles from where I live and when it gets dry the wild life cant even get a drink. They can dig a few water holes in there; this would help so water would stay there and they don't need that much land.

I like to see some wild life around. I have two water ponds on my farm land and have trees planted so they have a place for shelter and nesting area. I think the farmers are doing a good job to help wild life too. I do not think there is need for more land in wild life in North Dakota.

I think the best way is to stop the Burlington Dam and take a good look at what else can be done. the dams in Saskatchewan and Manitoba, some improvement on Lake Darling, and the people doing a little to help.

Lets preserve the valley, prime farm land we need for our livelihood and leave our local and County tax base the way it is.

We must use discretion on federal money. Saving the valley also means working together for one Cause. if that dam goes in im sure the relationship of Minot and the surrounding area will be lost.

We need each other, Lets work together!

Concerned farmers
Mr and Mrs Ruben Groveth

Deering, N.D.
Dec. 18, 1977

Department of the Army
St. Paul District, Corps [illegible]
1135 U.S. Post Office [illegible]
St. Paul, Minnesota [illegible]

Dear Sirs:

I am writing you this letter out [illegible] for the well-being of the Souris River V[illegible] valley, and adjacent [illegible] the valley. More specifically, I feel [illegible] control for the valley (for the city [illegible] U.S. Corps of Engineers [illegible] the total picture considering the [illegible] valley [illegible] region.

From the viewpoint of the people [illegible] ton Dam project is [illegible] sol[illegible] 2000 year flood protection [illegible] part. They have everything to gain [illegible] munity and environment [illegible] to gain.

The Souris River Valley historic[illegible] scenic [illegible] of this [illegible] woodlands [illegible] wildlife habitat it [illegible] our state. Then during the 1930's [illegible] duced much of this to m[illegible] marsh [illegible]. Now part of [illegible] remains in its natural [illegible] erable [illegible] let with protruding dead trees [illegible] approximately once every 30 years [illegible].

A local farmer [illegible] summer [illegible] trip to Russia. He asked the Russians [illegible] the cold, windy hills. The Russians [illegible] build cities on [illegible] valley [illegible] Then when floods come we lose all.

Can we justify a [illegible],000,000 [illegible] flood protection for a city [illegible] flood [illegible] dev- eloped in the first place? The[illegible] have continued to [illegible] from Uncle Sam [illegible].

I live [illegible] had a [illegible] loss of [illegible] rade- veloped its floodpl[illegible] trails [illegible] wildlife [illegible] City, N.D. They [illegible] of nature. They [illegible] redevelo[illegible] harmonious with nature.

There are some promising alternative solutions [illegible] flood problem which should be given further evaluation. [illegible] Quality Plan, outlined by the [illegible] andum2, solves alot of problems [illegible] Project. The city of Minot [illegible] protection) on a silver platter with [illegible] momumental dry dam is unnecessary [illegible].

The Canadian government [illegible] the Souris [illegible] from [illegible] of [illegible] come. Their objective [illegible] not just flood control. Let's look at [illegible].

[illegible] natural enviroment is [illegible] consumed by [illegible] welfare [illegible] rate. [illegible] to live on [illegible] The [illegible] of this earth are dished out only once. Lets not take [illegible] for only selfish motives.

Thank you for your time in considering the thoughts contained in [illegible] letter.

Sincerely,

Kenneth Niewoehner

Kenneth Niewoehner

Mohall, N. Dak.
Dec. 15, 1977

Dept. of the Army
St. Paul Dist. Corp of Engineers
St. Paul, Mn.

Dear Sirs:

Valley

In regards to the Souris River protection for the city of Minot, N. D. [illegible] the Alternative 15 (E Q Plan) [illegible] with the Canadian Government in helping the build [illegible] structures in Saskatchewan and Manitoba [illegible] Souris River Basin flood [illegible] use year around. This [illegible] problems in this basin.

[illegible] taxpayer of Renville County [illegible] rt. The few areas for re- [illegible] s the Mouse River [illegible] place since the early 1900, [illegible] ith Dakota. Therefore I feel strongly that [illegible] as well as the McKinney Cemetery should [illegible] reserved, besides Renville County cannot afford to have [illegible] of taxation.

Very truly,

Mrs. Erma Aalund

2-

Dec 17 1977

Donald Bell
[illegible]
[illegible]

Dear [illegible] [illegible] farmers in Bottineau and
[illegible] against the Burlington
McHenry County plan [illegible] the loss of prime farm
land [illegible] tax base
[illegible] a disastrous project.
[illegible] will some
day [illegible] years of
[illegible] all the cost.
[illegible] 15 CE (plan) would
[illegible] the wealth of the state

[illegible]

[illegible]ald Bell

Dec. 16, 1977

Newburg, N.D. 58762

Department of the Army

St. Paul District, Corps of Engineers

1135 U.S. Post Office & Custom House

St. Paul, Minnesota 55101

Dear Sirs:

I am writing this letter in regard to the Draft Environmental Impact Statement for October 1977 for flood control in the souris river valley. I am very much opposed to the Burlington Dam proposel and favor alternative 15 of the Environmental Quality plan. It seems in the long run it would offer better flood protection for all concerened, and do far less environmental damage to the valley. I farm in the Newburg, N.D. area and nate to see any prime farm land wasted or runined when it can be avoided. I hope this letter will be used in your consideration of alternatives to the Burlingtion Dam. Thank you very much.

Sincerely,

Raymond Boll

Raymond Boll

STATE BANK of Towner
[illegible] ER, NORTH DAKOTA 58788

December 21, 1977

D[illegible]rtment [illegible] the Army
S[illegible] Paul District, Corps of Engineers
1[illegible] U. S. Post Office & Custom House
S[illegible] Paul, Minnesota 55101

[illegible]n:

[illegible] letter is to v[illegible] opposition to the Burlington Dam for the following [illegible]s.

[illegible] area and [illegible] community of Towner are heavily dependent upon [illegible] successful prod[illegible]ion of beef cattle. The stability of the industry [illegible] upon margi[illegible] land that efficiently produces grass for pasture, and [illegible] excess [illegible] twelve [illegible]usand acres of flood irrigated meadows which provide [illegible] f nat[illegible] hay for wintering the cow herds. Timing of the [illegible] l in obtaining maximum production. Natural spring [illegible] short [illegible] f time and immediate drainage provides sufficient [illegible] growth [illegible]lows time for drying and mechanical harvesting of hay.

Prolonged flooding [illegible] past flood years has destroyed the natural flora of native grasses and [illegible]dges, which in turn greatly reduces quality and quanity of hay produced.

[illegible] of the [illegible] River on the [illegible]wer end can handle approximately the [illegible] amount of wa[illegible] that went through Minot. Prior to rechannelization, [illegible] flow [illegible] been and will be detremental to feed production in [illegible] area. [illegible] is our belief that a dry dam and subsequent water [illegible] will ext[illegible] the length of time of flooding long enough to be harm-[illegible] meadow[illegible] this area.

[illegible]tion, farm [illegible] ranch buildings are subject to flooding and methods [illegible]tion are required to prevent re-occurring financial loss and [illegible]nse.

[illegible] Citizens Unit[illegible] to Save the Valleys have studied the alternative to the [illegible] River flooding problems extensively, and it is our feeling that a [illegible] consideration to the alternative expressed by this group [illegible] taken.

Sincerely,

Laverne C. Kraft

Laverne C. Kraft
Vice President

LCK/cmj

A FULL SERVICE BANK

243

[illegible], N. D.
[illegible] 17, 19[illegible]

U.S. Army
Dist. [illegible] Engineers
St. Paul Minn.

Sirs:
I am [illegible] in opposition to your proposed plan [illegible] flood control on the Souris River which includes the Burlington Dam. Why should Renville County be penalized to provide flood control for the city of Minot, and Minot pay for their own flood control and this can be done by using Alternative 5 (C.G. Plan) and also cooperating with the Canadian government. Control structures built in Saskatchewan & Manitoba would give the whole Souris River Basin flood protection and a water supply for use the year around. I want you to know I am very much opposed to any flood control plan that includes the Burlington Dam!

Yours truly,
[illegible] Parker

Medical Arts Clinic, P.[illegible]

[illegible] AVE. S.E. • BOX [illegible]
MINOT, NORTH DAKOTA 587[illegible]
PHONE 701 852-412[illegible]

VELVA MEDICAL CENTER DIVISION
VELVA, NORTH DAKOTA 58790
PHONE 701 338-2[illegible]

PHYSICIANS AND SURGEONS
[illegible]

FAMILY PRACTICE
[illegible]
Velva Medical Center Division
[illegible]

INTERNAL MEDICINE
[illegible]

GENERAL SURGERY
[illegible]

OBSTETRICS-GYNECOLOGY
[illegible]

PEDIATRICS
[illegible]

DERMATOLOGY
[illegible]

UROLOGY
[illegible]

RADIOLOGICAL CONSULTANTS
[illegible]

ADMINISTRATION
[illegible]

December 16, 1977

De[illegible] of the Army
St. Paul District Corps of Engineers
[illegible] Post Office and Custom House
St. Paul, MN [illegible]

Gentlemen:

I am writing to express my concern over the proposed Burlington Dam on the Souris River near Minot, North Dakota.

I feel very strongly that flood protection in our area is needed. However, I feel that the Burlington Dam itself is an ill-advised project and that other alternatives are certainly available. I would [illegible] alternative [illegible] plan and would certainly encourage [illegible] with the Canadian government in building flood control structures in the provinces of Saskatchewan and Manitoba. The Burlington Dam project itself provides flood control only for Minot [illegible] rural areas upstream or downstream and, indeed, is [illegible] to be detrimental to these interests.

I thank you for your kind attention. I remain,

Sincerely,

M. Byron Grubb, M.D.

No. 177

[illegible] [illegible] and [illegible] appeared to
[illegible] the [illegible] plans for the [illegible]
[illegible] Lauris River. We are not
[illegible] that far [illegible]
[illegible] than [illegible]
would be studied more fully
[illegible] gratification
[illegible] and they will

[illegible]
[illegible] the agricultural
[illegible]
[illegible] forcing good
[illegible] life

[illegible] Alternative 15 (E.C. Plan)
[illegible] behind the [illegible] plan.
[illegible] all you can at least
[illegible] on this.

Very truly yours,
[illegible] Harry Haberty & [illegible]
[illegible], N. Dak. 58[illegible]

Minot, No Dak
Dec 13 1977

Dept. of the Army
St. Paul Dist. Corps of Engineers
1135 U. S. Postoffice & Custom house
St Paul, Minn 55101

Dear Sir

As you must know by now that there is a lot of opposition to the Burlington Dam and flood controle for Minot. A great many people in Minot are not in favor of the Corps Burlington dam, and all the rural and small towns are against the flood controle proposed by the corps.

The alternative 15 E 9. plan and damen Canada would save money and also this valuable valley land.

Please take a hard look at the facts before you approve this project

Sincerely
Henry & Mary Stammen
RR6 Minot, No Dak 58701

Tolley N Dak
Dec 17, 1977

Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Sirs,

We are in favor of Alternate Plan 15 for the flood control of the Souris River at Minot. We believe it would be a good plan for Minot with protection from Gasman Coulee and the Des Lacs Valley and it would not hurt us here in the Upper Souris area.

We hope something can be done in cooperation with Canada to give us flood protection for the whole Valley.

Sincerely,
Mr & Mrs Harry Ostlund

[illegible], N.D.
Dec. 9, 19[illegible]

~~General~~ Morris
Army Corps of Engineers
1135 U.S Post Office + Customs House
~~Washington D.C.~~ [illegible]

Dear ~~General~~ Mr. Morris:
I am writing in regard
to the proposed Burlington Dam north
west of Minot, N.D. [illegible]
much opposed to the building of
this dam and the destruction and
waste of the farm land and valley
of rich pasture land [illegible]
rural people [illegible]
dwellings many [illegible]
are 3rd and [illegible]
homesteading [illegible]
more than [illegible]
of anyone. [illegible]
often [illegible]
+ town to [illegible]
there [illegible]
must the farmers + ranchers be
expected to give everything they
own and their life work.
What about [illegible]
acres for the U.S Fish & Wildlife
where did they get the land in
the first place? They took it from
other farmers [illegible] the [illegible]
live in the valley before the present
Dam was built. [illegible]
talk as though [illegible]

the fish & wildlife.
We live adjacent to the refuge by the Grand Crossing and have already lost pasture land to them it now grows to waste and harbors predators like skunks & etc.
What about food for people meat for people - lets remember them. ~~most~~ all of the ducks feed on the farmers land instead of the refuge anyway they fence it but ducks & wildlife don't pay any attention to fences they are on the farm fields when they are hungry.
In the future they are concern about food production Lets not loose any more precious farm & pasture land or we'll some day end up with a food shortage as well as an oil or energy shortage.
I say people should come before ducks.
There are alternate flood control plans that can be used instead of this large ~~dam~~ dam. Also this dam could break like so many others, I wouldn't want to live below it I know that.
We prefer alternate #5 (EQ) plan.

Sincerely, a concerned citizen to Save the Valley.
Mrs. Jack Miller

Department of the Army
St Paul District, Corps of Engineers
1135 U. S. Post Office & Custom House
St Paul, Minn. 55101

Sir: I am sending you a copy of a letter I sent to General Morris, Wn. D.C. - Dec. 12, 1977
I believe the content of this letter is vital to our survival.

Anna L Krenz
Mohall, N.D.
12-15-77

Mohall, N. Dak.
Dec. 1977

General Morris
Army Corps of Engineers
Washington, D.C. 20006

Dear General Morris

I'm writing you, General Morris, protesting the decision of the Army Corp of Engineers relative to the building of Burlington Dam North of Minot, North Dakota and the raising of Lake Darling Dam. I live north of Minot, in the Mouse River Loop.

The recent publishing of a report states this;-"The Burlington Dam as of now planned and the raising of the level of Lake Darling Dam will not accomplish the desired <u>adequate</u> flood protection for Minot."

If the Burlington Dam is built and Lake Darling Dam raised , our beautiful Natural River Valley will be destroyed. Many acres of prime farm land (the best in N.D.) and grazing land will be destroyed forever, both above and below Minot.

Our homes will be destroyed. We will be dis-placed persons (D.P's), just like Hitler's D.P's in Germany. We are being treated just like the Indians, driven from our homes to give the land to the Fish and Wild Life, and Minot still will not have adequate flood protection.

Don't you people consider us U.S. Citizens?-What is happening to our Great Republic? Life, Liberty, and the persuit of Happiness?-Are we pawns in the hand~~les~~ of our governmental bureau-crats?-Is only Minot and the Fish and Wild Life to be considered? Please think about these questions and answer them.

Our United Citizens to Save our Valley must fight every step of the way, we have no other recourse. We'll do everything in our power to protect our rights as bona-fide United States Citizens of the greatest Nation in the world. Lets keep it great!

We <u>want</u> flood control for Minot and know there are alternatives, at least four or five. I believe the diversion tunnel under Minot is one of the best. The river valley would be saved and none of the people ~~farmers~~ living in the Valley would be D.P's.

Here is a quote to <u>digest</u>."Where economic Freedoms are encouraged <u>Human rights tend to prosper</u>."

Yours truely,

Anna L. Krenz

[illegible], N.D. 58732
12-16-77

Dept. of the Army
St Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St Paul, Minn 55101

Dear Sirs:

Thank you for the packet of information regarding the various flood control plans for the Souris River Valley.

After studying the Draft [illegible], I wish to go on record as favoring Alternate 15, because this plan would better serve the needs of all people living in the Souris River Basin. Burlington Dam could not [illegible].

However, we whose homes and livelihood are in the flood plain, and those who live in adjacent areas, would urgently beg of you to give full cooperation to the Canadian Government in helping them build control structures in Saskatchewan as additional protection to the whole Souris River Basin. This also would preserve a supply of water all year around.

[illegible] Nelson
([illegible])

Mohall N D
Dec 14 - 77

[illegible] Army
[illegible], Minn. 551[illegible]

Dear Sir
I am writing in regards
to [illegible]
I have lived for 68 years
[illegible] townships, Renville County

[illegible] Burlington Dam.
[illegible]

I [illegible] much
why should a small county
[illegible] asked to pay [illegible]
[illegible] ~~problems~~ [illegible]

There has been no effort to
work with Saskatchewan or Manitoba
Must have a [illegible]
Why not use Corps of Engineers
Alternative 15 [illegible]
Less interruption of normal [illegible]
[illegible]
Saskatchewan and Manitoba [illegible]
Thank you
Yours truly

1932 1st ave. S.W.
Minot, N. Dak. 58701

[illegible]

[illegible] to voice my opposition to
[illegible] Dam
[illegible] prefer alternative 15 (E[illegible] plan)
[illegible] we should cooperate with
[illegible] ment in helping them
[illegible] structures in Saskatchewan
[illegible] nitoba.

Yours Sincerely
Leland Burtness

[illegible]
[illegible], N.D.
58[illegible]

12-19-[illegible]

Dept. of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Sir:

I especially am opposed to the Burlington dam [illegible] for the acquisition of permanent [illegible] and wildlife purposes. [illegible] (? plan) [illegible] arrangement in cooperation with the Canadian government [illegible] for the [illegible]

[illegible] for the [illegible] of any

[illegible] yet.

[illegible] farm land which [illegible] wildlife to replace [illegible] by Burlington dam [illegible] to take a farmers living. It does not make [illegible] wildlife and the [illegible] farming [illegible] to live in the [illegible]

[illegible] should be

I think [illegible] that [illegible]

[illegible] the [illegible] of the [illegible]

Thanks for your consideration

Yours Truly
[illegible signature]

[illegible], N.D.

12-16-1977

[illegible] of the Army

St. Paul District, Corps of Engineers

[illegible]

I am a concerned land owner of [illegible] County, and am very much against [illegible] proposed [illegible] Dam.

[illegible] the alternative of the [illegible] recently planned a little [illegible]

I [illegible] would ask [illegible] the [illegible] together with ~~[illegible]~~ Canada [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] and proposal [illegible] that may cost more, but I hope you will consider the rural area that will be disrupted with the building of the [illegible] Dam. [illegible] acres needed for wildlife replacement from other area counties.

Yours Truly

Embert [illegible]

Newburg N. Dak
Dec 16, 1977

Dept. of the Army
St. Paul Dist, Corps of Eng
1135 U.S. Post Office & Custom House
St Paul, Minn. 55101

Dear Sirs:

I am opposed to your plan of the Burlington Dam for flood control for Minot, N.D., especially the mitigation of more land to the Wildlife Service.

I feel along with the Citizens United to Save the Valleys, that the Alternative 15 (E.Q. Plan) has a more logical solution. You should also cooperate with the Canadian government on flood control projects up there.

Thank you.

Sincerely,

[illegible]
Box 81
Newburg N Dak.
58762

12-16-77

[illegible] Forrest T. Gay [illegible]
[illegible]
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

I am writing both as a private citizen and as the Chairman of the meeting held in Lansford on Nov. 11, 1977. There were 300 people met in Lansford and voiced unanimous support for [illegible] to save the valley in the [illegible] to head off the [illegible] Burlington Dam on the Souris River.

Since that meeting and the [illegible] meetings at Westhope, Mohall, [illegible], Kenmore the feeling [illegible] that Alternative 15, the Environmental Quality Plan, which encompasses Alt. 4 in it, would better serve the needs of all the people residing in the Souris River Basin.

1. It provides a 100 year [illegible] for Minot from the Souris [illegible] [illegible] from a much greater [illegible] [illegible] [illegible] can [illegible] [illegible] from [illegible] Canadian [illegible] [illegible] Rivers would [illegible] to Minot from a storm centering in these two regions.

2. Preserves the valleys in their natural state.

3. No land mitigation needed for environmental losses.

4. Preserves the prime farm and range land up stream.

5. No farm and ranch relocating.

6. Preserves McKinney Cemetery

7. Preserves Mouse River Park, no removal of some 85 summer res.

8. Down stream farmers and ranchers would not receive the annual prolonged flooding situation.

9. Current transportation crossings in Ward and Renville Counties [illegible] 1950 [illegible] use [illegible] farmers and others.

10. Local and county tax base would not be affected.

The people of the Lansford meeting preferred Alternative 15 (? Plan) and encourage cooperation with the Canadian government in halting them [illegible] federal governments in Saskatchewan and Manitoba to [illegible] whole Souris River Basin flood protection and a water supply for use year round.

Michael Gates
Lansford, N.D. 58750

Tolley, N. Dak. 58787
Dec. 17, 1977

Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Corps of Engineers,

Our farm is located on the Souris River Valley and we have gone thru just as many floods as Minot. We have never had help from the government like Minot, just from our friends and neighbors who would so gratuitous give of their time and help.

We feel the Burlington Dam is just another way for Minot alone to get help

2.

from the floods along the Souris River Basin. We prefer the Alternative 15, The Environmental Quality Plan, And encourage Cooperation with the Canadian government in building structures in Saskatchewan and Manitoba to give help to the whole Souris River Basin.

Why should one area benefit when there is another alternative that will benefit the whole Souris River Vally and preserve our beautiful environment that our older generation had the courage to homestead and develop for generations to come

Therefore we hope

3.

you will give Alternative 15, The Environmental Quality Plan, careful study and recommend it for the good of everyone involved.

Thank you
Yours Truly,
Mrs. Richard Johnson
Tolley, N. Dak. 58787

Lansford, N Dak
Dec 15, 1977

Dept. of the Army,
St. Paul's District, Corp of Engineers,
1135 U S Post Office & Custom House,
St. Paul, Minn. 55101

Gentlemen:

As a member of United to Save the Valley, Mohall, N. Dak., we are opposed to flood control on the Souris River, North west of Minot, as it now stands, including Burlington dam, and we prefer Alternative 15 (C' Q plan), and cooperation with the Canadian Government for the flood control needed, and year round water supply for cities in the area

Sincerely yours
Mr & Mrs C. L. O'Keeffe.

Mohall, N. Dak
Dec 15, 1977

Dept. [illegible]
St. Paul [illegible] of Engineers
[illegible] Building [illegible]
St. Paul, [illegible]

Gentlemen
The [illegible] proposed Burlington Dam on the Souris R[illegible] to this dam as your proposed dam [illegible] Minot. Minot will receive all [illegible] counties of Renville, Ward, [illegible] give up lands, farms, [illegible] Mouse River Park, McKinney Cemetery [illegible]. Once the water is backed up behind the [illegible] trees, shrubbery, grass will be [illegible]. Does this make any sense?
[illegible] Township of Renville Co. [illegible] (EQ Plan) for the necessary flood [illegible] but then all the prime farm [illegible] in production as it should. Also we [illegible] association between U.S. and Canada so that water [illegible] structures could be built in Saskatchewan and Manit[illegible] could give flood protection for the whole Souris B[illegible] [illegible] that you will give serious consideration to the affected counties and their plea that you not go any furth[illegible] with plans to build Burlington Dam. Thank you

Sincerely Yours,
L. Wilbur Johnson, R.R. 1
Lois L. Johnson Mohall, N. Dak 58761

1704 1st Ave. S. W.
Minot, North Dakota 58701
December 16, 1977

Department of the Army
St. Paul District, Corps of Engineers
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

[illegible]

As a member of Citizens United to save the Valleys, and also a property holder in Renville County, I wish to say that I am in objection to the Corp's proposed plan for flood control on the Souris, which includes the Burlington Dam.

I believe the alternative 15 (E.Q. Plan) is more suitable and also cooperating with the Canadian Government to build control structures in Saskatchewan and Manitoba to give the whole Souris River Basin flood protection and a water supply for the year around use. This is a more sensible solution to the problem in the basin.

Sincerely yours,

L. J. Buzzell

L. J. Buzzell

LJB:ms

Dept of the Army
St Paul Dist Corp of Engineers

Dear Sirs

As landowners in both Renville + Bottineau counties we would like to express our concern and objections to the corps proposed plan for flood control on the Souris River which includes the Burlington dam. We prefer Alternative 15 (E C C Plan) + encourage cooperation with the Canadian government.

Mr + Mrs Dale Keith
Sherwood, N. D.

GRANVILLE PUBLIC SCHOOL DISTRICT

NUMBER 25 McHENRY COUNTY

Granville, North Dakota 58741

December 15, 1977

Department of the Army
St. Paul Dist. Corps of Engrs.
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Sir:

On behalf of the Granville School District, I want to present comments concerning the "Draft Environmental Impact Statement October '77". This concerns the flood control plans for the Souris and Des Lacs Rivers.

We feel that Alternative 15, The Environmental Quality Plan, which encompasses Alt. 4 in it, would better serve the needs of all the people residing in the Souris River Basin.

Alternative 15 (E Q Plan) is prefered, and we express our objections to the Corp's proposed plan for flood control in the Souris River Basin.

We would like to see some cooperation with the Canadian Government to find a better solution to the problems in the Souris River water shed--in United States as well as in Canada.

Sincerely yours,

Clarence E. Sauer, Supt.

sn

[illegible] N. D. 58725

Dec. [illegible], 1977

Dept. of the Army
St. Paul Dist., [illegible] of Eng.
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Sir:

I'm a young farmer who will be affected by the proposed Burlington Dam and I am very much opposed to this type of flood control. The Burlington Dam [illegible] irreplacable wildlife [illegible] to local school districts, [illegible] tax [illegible]; all this without providing adequate flood control.

Flood [illegible] achieved with the least distruption [illegible] using Alternative 1[illegible] the Environmental Quality [illegible] the Army Corps of Eng. [illegible] Impact Statement concerning flood control on the Souris River, North Dakota. Using Alt[illegible] with a cooperat[illegible] in Saskatchewan and [illegible] to provide flood [illegible] Souris River Basin and stable annual water supplies.

This is the most logical solution.

Sincerely

Bruce D. [illegible]

Bruce D. Nels[illegible]

Mohall N Dak
Dec-14-1977

Dear Sir

In regard to the flood problems on the Souris River Valley and [illegible] I prefer Alternative 15 (E & Plan [illegible]) And cooperation with the Canadian Government in helping them build control structures in [illegible] and [illegible] to give the whole Souris River Basin flood protection and a water supply for use year round this is the [illegible] solution [illegible] [illegible] in [illegible] of the Burlington Dam.

I am a member of (Citizens [illegible] to save the Valley)

Palmer Johnson
Mohall N. Dak. Renville Co.

AD-A120 211 CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT F/G 13/2
BURLINGTON DAM, SOURIS RIVER, NORTH DAKOTA, FLOOD CONTROL. FINA--ETC(U)
JAN 78

UNCLASSIFIED NL

4 OF 4
AD A
120211

END
DATE
FILMED
11-82
DTIC

12/14/77
Y Ranch
Sherwood, N.D.

Attention:
Department of the Army,
Corps of Engineers,

I think the Burlington Dam is a very unjust plan of flood protection for Minot. Because, Minot is the only ones receiving benefit, while the people up & down stream will pay dearly.

I think alternate 15 (C G plan) is what we should work for. We should cooperate with the Canadian gov. in helping them build Control structures in Sask. & Manatoba to give the whole Souris River Basin flood protection and water supply for use the year round.

I refuse to give up my land for a plan that just don't make sense.

Leo & Janice Volk
Farmers
& Rancher

Denbigh, N. Dak. 58732
Dec. 15, 1977

Dept. of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minn. 55101

Dear Sirs:

We are opposed to Burlington Dam because we live by the river near Towner and raise cattle. [illegible] summer release of water would affect our wild grass hay meadows and hay crop plus making some of our land of no use because of salinity of soil, which will also destroy the trees that are native timber.

We are in favor of Alternative 15 (EQ plan) and encourage cooperation with the Canadian government in helping them build control structures in Saskatchewan and Manitoba to give the whole Souris River Basin Flood Protection and a water supply for use year round.

Burlington Dam is not the solution to the total water problem in this basin.

Sincerely,

Melvin H and Vera L Nelson

Mohall, N. Dak.
December 1 , 19 7

Dept. of the Army
St. Paul Dist. Corps of Engineers
1135 U.S. P.O. & Custom House
St. Paul, Minn. 55101

Dear Sirs:

I am writing in regard for my concern and objection to the Corps' proposed plan for flood cntral on the Souris River which includes the Burlington Dam.
I prefer Alternative 15 (EQ Plan) and encourage cooperation with the Canadian government in helping them build control structures in Saskatchewan and Manitabo to give the whole Souris River basin flood protection and a water supply for use year round.

This is the logical solution to total water problem in this basin.

Sincerely,

Hора Johnson
Land Owner
in Renville Co.

Carpio, N. Dak.
Dec 15, 1977

Dept of the Army
... Corps of Eng.
... Minnesota

Dear ...:

... the Board of Education
of ... Public School Dist. 15-6,
... to ... on record
... and objection
to ... plan ... Flood Control
on ... , includes
... (Alternative ... 2 Plan)
... to ...
... government in
... Control structures
... and Manitoba
... for the whole ...
to ...

Yours truly,
By Board of Education
Carpio Public School Dist.
[illegible], Clerk

Peggy Thorenson
Newburg, ND

Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Sirs:

I am a concerned farmwife opposed to the Burlington Dam. The dam has nothing to benefit our area--only Minot.

Alternative 15, The Environmental Quality Plan, serves the needs of the people in the Souris River Basin better. It would provide Minot with protection from Gasman Coulee and the DesLacs River, which the Burlington Dam does not. It would preserve the valleys as they are now and keep from taking farmland out of production. Also, wildlife land would not be harmed so mitigation acres would not be needed. McKinney Cemetery and Mouse River Park would also be preserved. County roads would be preserved and local and county tax base would not be affected.

I also encourage cooperation with Canada to implement a total water management and flood control policy.

This is the logical solution to the water problems of this basin.

Sincerely,

Peggy Thorenson

Peggy Thorenson

Dale Thorenson
Newburg, N. D.

Department of the Army
St. Paul District, Corps of Engineers
[illegible] U. S. Post Office & Custom House
St. Paul, Minnesota 55101

[illegible]:

I am a North Dakota farmer in Bottineau County and am opposed to the Burlington Dam which the Corps of Engineers [illegible] to build. I feel it is an unnecessary step being [illegible] for flood control.

I am in favor of Alternative 15, the Environmental [illegible] mentioned in the Environmental Impact Statement [illegible] October, 1977. It would provide Minot with [illegible] protection than the dam because the Gasman [illegible] River would also be controlled. It would [illegible] the valleys as they are now, and keep from [illegible] farmland in the valleys. No wildlife [illegible] would [illegible] mitigation acres would not be needed. [illegible] would also be preserved along with [illegible] and county roads would not be inundated by [illegible], and local and county tax bases would be [illegible]

I also support an international group made up of people of the Souris loop from both Canada and the U. S. to plan overall flood protection and water management.

[illegible] the people of Bottineau, Renville, and McKenry Counties are opposed to this needless dam.

Respectfully yours,

Dale Thorenson

Dale Thorenson

[illegible]partment [illegible] Army
St Paul District, Corps of Engineers

To Whom It May Concern:

I am writing in regard [illegible]
[illegible]ington [illegible] me. I farm in [illegible]
in [illegible] County, [illegible]
[illegible] Minot [illegible]
Which is [illegible] to be [illegible]
Corps of Engineers [illegible] With [illegible]
feel this [illegible] being very [illegible] farm[illegible]
who are [illegible] to give up [illegible]
Three [illegible]
farmed [illegible] able
Now they [illegible] take [illegible]
land for [illegible]
I feel [illegible]
this arrangement [illegible]
[illegible]
[illegible]

Mohall, N. Dak.
Dec. 15, 1977

Department of the Army
St Paul [illegible] Corps of Engineers
1135 [illegible] Post office & Custom House
St Paul, Minnesota 55101

Dear Sir,

I am writing to express my [illegible] about the proposed plan for flood [illegible] on the Souris River in Northern N. Dakota. The [illegible] Dam as proposed by the Corps of Engineers, to hold back excessive [illegible], which originate in Sask. Can. would destroy a beautiful and [illegible] Valley and because of [illegible] inundation would destroy [illegible] wooded valley and productive [illegible] lands. This is also a fine [illegible] habitate.

[illegible] that Alternative No 15, of the [illegible] different alternatives discussed in [illegible] draft Environmental Statement would better serve the needs of [illegible] people of the Souris River Valley

Respectfully Yours
Conrad Haarsager
Mohall, N. Dak.

Sherwood, N. Dak.
December 1[illegible], 19[illegible]

Department of the A[illegible]
St. Paul District, Corps of Engineers
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Gentlemen:

With reference to the "Draft Environmental Impact Statement October '77", to the propo[illegible] Burlington Da[illegible] and raising Lake Darling Dam relatin[illegible] to the McKinney Cemetery.

First, the McKinney Cemetery As[illegible] is not o[illegible] to flood control for Minot, however, [illegible] believe th[illegible] tire Souris River Basin and De[illegible] Lac[illegible] [illegible] considered. There are several alter[illegible] tives [illegible] eliminate the need of relocating or [illegible] McKin[illegible] Cemetery.

We prefer Alternative 15 (E[illegible] Plan) and encour[illegible] cooperation with the Canadian Government in helpi[illegible] build control structures in Sa[illegible] give the whole Souris River Basin [illegible]ood pro[illegible] water supply for use year round.

McKinney Cemetery located [illegible] is a very Historical and Scenic [illegible] recorded graves dating from 1912 [illegible] graves dating from 1886, when the [illegible] used. There are Civil War veteran[illegible] of both World Wars and many [illegible]

Because of the Scenic and [illegible] of McKinney Cemetery, the McKin[illegible] unalterably opposed to relocati[illegible], [illegible] cemetery. It would destroy the Scen[illegible] cemetery would lose its Historic[illegible]l [illegible].

We plead that the alternative 15 [illegible] be used in managing the Souris River to save our Cemet[illegible] in it[illegible] present form.

Your[illegible]
Paul Krenz
Paul Krenz, Pres.
McKi[illegible] Cemetery

December 14, 197;

Corps of Engineers
St. Paul District
St Paul, Minn.

Dear Sir:

I wish to express my strong opposition to the Burlington dam proposal.

I will, however, support Alternative 15, the Environmental Quality Plan.

Yours truly,

James Reinarts
Route 6
Minot, No. Dak. 58701

SENATE CHAMBER

Forty-fifth Legislative Assembly

STATE OF NORTH DAKOTA

BISMARCK 58505

Sen. Walter C. Erdman
District 6
1202 Bennett Street
Bottineau, ND 58318

Committees
Appropriations

Bottineau, N. Dak.
December 15, 1977

Colonel Forrest T. Gay, III
Department of The Army
St. Paul District, Corps of Engineers
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay III,

Enclosed you will find a copy of my remarks in opposition to the Burlington Dam which I delivered recently at area informational meetings. I have made a thorough study of "Draft-Environmental Impact Statement-Flood Control-Burlington Dam-Souris River, North Dakota", whereby, I came to the conclusions which are outlined in my remarks.

I respectfully request that you evaluate them and base your opinion accordingly.

Sincerely,

Walter C. Erdman

INCLOSURE TO SENATOR ERDMAN'S LETTER

[illegible] 16, [illegible]

[illegible] Citizens:

[illegible] the fact that [illegible] the organization [illegible] as Citizens [illegible] are opposed [illegible] control for the [illegible] We are, however, opposed [illegible] the present [illegible] the Army Corps of Engineers because of its adverse effects in our area. [illegible] alternatives!

It appears unreasonable [illegible] Rittinger, [illegible], Reynolds, and Ward [illegible] have contributed generously [illegible] fish and wildlife programs [illegible] the past [illegible] should be required to [illegible] additional acreage. [illegible] date, the United States Fish and Wildlife Service [illegible] 22,722 acres [illegible] acres [illegible] County [illegible] five townships. In addition, [illegible] actual [illegible]

[illegible] ,
[illegible] ,
[illegible] the land from use [illegible] Company [illegible] the [illegible] Industry [illegible]

The United States Fish and Wildlife Service [illegible] 2, [illegible] acres [illegible] would represent 45 percent [illegible]. They maintain that [illegible] acres [illegible] at some future date [illegible] additional study. Further[illegible], they [illegible] studies [illegible] project features not yet [illegible]. Finally, [illegible] of the reservoir [illegible] would require [illegible] plan [illegible]

There is also the matter [illegible] flooding in the [illegible] which flooding easements would be taken. [illegible] owners and ranchers in this area [illegible] compensation.

At this point [illegible] 172 of the Environmental Impact Statement [illegible] the proposed [illegible] listed are bottomland [illegible] land and grassland, totaling some 14,[illegible] acres. [illegible] this acreage would be required by fee [illegible] what the compensation would be.

INCLOSURE TO SENATOR ERDMAN'S LETTER (CONT.)

In summing up the foregoing it is [illegible] that we could envision further encroachments by the Federal bureaucracy. It would appear that in the event Burlington Dam, as now proposed, were to become a reality, it would be a one-way street to short-term economic gains for a few at the cost of long-term environmental [illegible] and more economic losses to future generations.

I realize our time is limited to oppose Burlington Dam with its adverse effects. Since October of 1977 when the Army Corp of Engineers released "Draft Environmental Impact Statement - Flood Control - Burlington Dam - Souris River, North Dakota", the public has become aware of its ramifications. Those of us opposed to the dam have conducted a number of informational meetings in the area and there appears to be overwhelming opposition to the project.

In these remarks I have addressed myself mainly to the Fish and Wildlife mitigation acres and land acquisition aspects of the project. It will, however, have other human ramifications which are readily observable, such as the McKinney Cemetery, the Renville County Memorial Park, the relocation of rural and ranch residences, the abandonment of roads, etc. These are equally important.

In conclusion, the alternative I believe that would adequately serve the needs of all the people residing in the Souris River Basin is Alternative 15, The Environmental Quality Plan, which encompasses Alternative 4 in it as outlined in the Impact Statement of October, 1977.

1. It provides a 110 year protection for Minot from the Souris River, gives them a much greater and more complete plan for protection from Gassman Coulee and the Des Lacs River; would avoid a catastrophic flood to Minot from a storm centering in these two regions.
2. Preserves the valleys in their natural state.
3. No land mitigation needed for environmental losses.
4. Preserves the prime farm and land range upstream.
5. No farm and ranch relocating needed.
6. Preserves McKinney Cemetery.
7. Preserves Mouse River Park, no removal of some 80 summer residences.
8. Downstream farmers and ranchers would not receive the annual prolonged flooding from a dam.
9. Current transportation crossing in area counties would be left to by farmers and others.
10. Local and county tax base would not be affected.

This is the logical solution to the total water problem in this basin.

Senator Walter C. Erdman

HOUSE CHAMBER

Forty-fifth Legislative Assembly

STATE OF NORTH DAKOTA

BISMARCK 58505

Rep. Richard J. Backes

December 14, [illegible]

Department of the Army
St. Paul District
Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Gentlemen:

RE: Draft Environmental Impact Statement
Flood Control
Burlington Dam
Souris River - North Dakota
Dated October 1977

Draft Review and Comments
Flood Control
Burlington Dam
Souris River - North Dakota
Design Memorandum No. 2
Phase 1 - Plan Formulation

I am writing in opposition to the Burlington Dam, and in support of the Army Corps of Engineers' alternative plan *featuring a diversion tunnel*.

The proposed Burlington Dam plan violates at least four areas of general public policy of the State of North Dakota.

1. Preservation of prime farmlands

1 The proposed Burlington Dam will inundate thousands of acres of farm and hay lands, most of which is prime valley bottom farmland.

Mitigation for fish and wildlife habitat losses would require another two to three thousand acres of mostly prime rated prairie lands.

The U.S. Fish and Wildlife Service estimates that the two to three thousand acres of mitigation only represents 65 percent of these losses. It possibly would ask for more mitigating acres after further study.

The State of North Dakota, through its legislative and executive agencies, recognizes the folly of the waste of this irreplaceable resource of prime farmland in its laws and regulations concerning industrial development.

Our siting and reclamation laws require no siting on prime farmlands and restoration of strip mining by replacement of up to five feet of topsoil.

Although these laws create additional costs in the millions, the resources are worth it.

2. The proposed dam will seriously degregate the environment.

As stated in both the Design Memorandum and the Draft Environmental Statement, even short-term flood levels would completely destroy all vegetation, including hundreds of acres of native trees (in a state that ranks 50th in woodlands) and all grasses.

2 The spectre of this beautiful valley being dead from Minot to the Canadian border (some 50 miles) is incredible.

The loss of prime wildlife habitat would be extreme since the valley carries the major portion of the necessary habitat. Most wildlife would not survive on the prairie because of the resultant loss of cover.

The State of North Dakota, through its air and water quality standards, its heavy investments in its park service, and its forestry school and service, have spent millions of dollars to improve or preserve North Dakota's environment. The proposed dam will offset these years of environmental work and expenditures.

3. The plan violates the general public policy of preservation of the family farm.

The dam will take thousands of acres of farmland from present family farms and ranches. The valley provides building sites with natural protection from the severe North Dakota weather. These sites cannot be replaced on the prairie.

3 The loss of these lands means either a less economic unit or fewer farmers. Farmers are the backbone of North Dakota's economy. This disastrous effect will not only be borne by farmers, but also by main street businesses (including Minot) and local governments in lost tax base.

The proposed dam, and the necessity to release the water before the next season, creates hardships on downstream farmers and ranchers by creating controlled flooding. Normally the downstream farmer expects

Corps Responses to Richard Backes' Comments

2. Comment acknowledged. The impacts of the proposed project on vegetation, wildlife habitat, and aesthetics are all addressed in the final EIS.

3. Comment acknowledged. The impacts of the proposed project on cropland are addressed in the final EIS.

the flood and its recession in a regular cycle in time to either crop or hay his land. Under this proposal this will not be the case, since the controlled flooding will eliminate the normal flooding and recession.

The state's general policy towards preservation of the family farm includes, among other things:

1. Farm financing through the Bank of North Dakota.
2. Tough laws on farm foreclosures.
3. Grants for rural water systems.
4. State payments for busing of school students.
5. Operation of the State Mill and Elevator.
6. Tax exemptions for farm buildings, including residences.

4. The proposed dam will violate the state's general public policy of preservation of recreation, scenic, and historic sites.

The proposed dam will destroy the historic Renville County Old Settlers' Park.

This park was established when the county was formed in 1912, and is supported by a county park levy. It has 80 cottages and homes plus assorted county buildings, and is a recreational facility for a large area beyond the county.

It is extensively used for area reunions, political meetings, and recreation. There is an annual old settlers' picnic honoring the area homesteaders.

The park cannot be replaced in the immediate area because the nearest woods and water area is at least 75 miles away.

Inundation will also disturb historic McKinney Cemetery where many of the valley's early settlers are buried.

The valley is steeped in our history and heritage. Ranchers settled the valley about 20 years prior to homesteading, and were instrumental in bringing in the various ethnic and religious groups for homesteading. Early post office, mission, and church sites dot the valley.

The State of North Dakota, through its Park Service, State Game and Fish Department, Recreation Department, Travel Bureau, Heritage Commission, and other agencies, has continuously, and at great expense, tried to preserve and enhance our recreational and scenic areas as well as our heritage.

Corps Responses to Richard Backes' Comments

4. The impacts of the proposed project on recreation, Renville County Park and McKinney Cemetery are addressed in the final [illegible] our support for the environmental quality plan will be considered in the decision making process.

Every policy must have some flexibility. First, alternatives that will accomplish the desired goal without the detrimental effects, even if costs are greater, must be explored. Secondly, an evaluation of benefits and adverse effects must be made to determine what serves the greater public good when no alternative is available.

Fortunately, the determination as to the loss of the valley for flood control for Minot does not have to be made in this instance.

The proposed alternative to the Burlington Dam is a diversion tunnel through Minot for flood protection of Minot's citizens. The benefits to Minot in flood protection will be equal or better, and the adverse effects I have described will be eliminated.

The proposed tunnel will protect Minot's citizens from all potential sources of flooding. Under the Burlington Dam proposal, even with the Des Lacs River diversion tunnel, if approved, Minot will still be prone to a disastrous flood from Gassman Coulee.

As stated in the Design Memorandum (page 19), "The coulee has a relatively high potential for causing severe damages at Minot due to its location and steep gradiant."

The Environmental Statement (page 126) further states:

> The Gassman Coulee lies only about 2.0 river miles above Minot and an intense rainstorm centered over its basin could result in serious loss of life in addition to large economic damages. While the possibility of a large flood on Gassman Coulee is remote, the only event of Standard Protection Flood proportions in the basin occurred on a coulee similar in size to Gassman Coulee. Bonnes Coulee, near Velva, experienced an intense rainfall event on 10 August 1962 when up to 10.5 inches of rain was reported in a period of about 4 hours. The average rainfall on the 46-square-mile area of Bonnes Coulee was estimated at 6.2 inches while the peak discharge was estimated to be from 12,000 to 23,000 cfs. Such an event on Gassman Coulee could result in a catastrophe. Once the flat Souris River flood-plain is reached, velocities would lower substantially, but peak stage in the Souris valley would occur, and reach Minot, much faster than peaks from the slow-rising Souris River (and thus allow little warning).

To further quote from the Design Memorandum (page 39):

> ". . . the EQ plan (diversion plan), plan 5 modified, would cause the least adverse impacts to existing social and environmental values and would lead to net positive contributions to the environment."

It appears the sole reason for the Corps' recommendation for the Burlington Dam is stated on page 35 of the *Design Memorandum*: emphasis on economic efficiency over environmental considerations. The economic efficiency will also be achieved at the cost of social, historic, and economic considerations to area residents.

North Dakota policy is not based solely on economic considerations over all other values. Neither is it the policy of the federal government, as evidenced by federal regulations, court decisions, and laws concerning the environment, public safety, preservation of historic and scenic areas, and a host of other policies, to place economic efficiency over other values.

[illegible] the proposed dam will force the [illegible] farm family residences upstream, plus [illegible] park.

It will destroy valuable farmland, native forests, wildlife habitat, historic sites, and portions of our heritage. *It will lose a veritable* onslaught of economic problems for farmers, businessmen, and local governments.

The proposed alternative (diversion tunnel) relocates 30 or fewer families in Minot by using alternative routes, and has *none* of the dam's detrimental environmental, social, or economic effects of the region.

In closing, to again quote from the Draft Environmental Statement (page 129):

> "The EQ alternative does create several adverse social impacts. The plan would require the relocation of mobile homes upstream from Minot. However, these structures are within the present floodplain, indicating that *the social costs of relocation* would not be imposed upon residents who would receive no benefits from an area flood control project. An additional adverse social impact of the EQ plan would occur with the likely conclusion that the project would be considered a local flood control project. *In this eventuality the city of Minot would be assessed* approximately $10 million in local cost-sharing charges. This would obviously place a substantial burden upon the community. However, it would be consistent with regulatory guidelines, since it would represent a more equitable distribution of costs and benefits. The *Principles and Standards* (P&S) for Planning Water and Related Land Resources address cost-sharing requirements in the following manner: "Reimbursement and cost-sharing policies shall be directed generally to the end that equal beneficiaries bear an equitable share of cost commensurate with beneficial effects *received* . . ." *Accordingly, the* assessment of cost-sharing responsibilities upon Minot, while substantial and institutionally unacceptable (to Minot), is recognized as equitable."

This statement fortifies the long established and equitable criteria that those receiving benefits should bear the costs.

The extra costs of the proposed diversion tunnel is a small price to pay considering all the adverse effects.

Sincerely,

Richard J. Backes

Richard J. Backes
State Representative
District 3

RJB/cu

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This channel begins in Bottineau County approximately one mile south of the Canadian border, so it must follow that any adverse impact suffered by Manitoba would also be suffered by Bottineau County. Further adverse impact is also suffered by Bottineau County since the 500 cfs prolonged release does not allow drainage from Stone Creek, Willow Creek, and Boundary Creek, the three major drainage networks for the Turtle Mountain area. This was not studied in your statement and when we called this to the attention of your Corps personnel during a meeting at the Bottineau County Court House, we were told this was not part of the project.

Sincerely,

C.R. Keller
411 Sinclair Street
Bottineau, North Dakota

cc. E. Zell Steevor, Executive Office of the President
Quentin Burdick, U.S. Senator
Milton R. Young, U.S. Senator
Mark Andrews, U.S. Representative
Arthur Link, Governor of ND

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December 16, 1977

U.S. Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Gentlemen:

I have reviewed your Draft for Review and Comment for the flood Control Burlington Dam project and make the following comments.

1 Increasing the level of Lake Darling will destroy the scenic beauty of the valley above Lake Darling. This area is now one of only two truly wooded scenic areas in north central North Dakota. In addition 6000 acres of prime farm land will be purchased above the dam and 16 farm families would be displaced. This can only result in a severe economic impact to that particular community.

2 The downstream portion of the flood control area was not adequately studied. Your Draft indicates downstream study areas stopping at J. Clark Salyer Refuge where all dams are to be raised one foot. No study at all was given the Willow Creek, Stone Creek and Boundary Creek areas which are the three major drainage areas for Bottineau County east of the river and ... Creek which is the major drainage area west of the river. The Turtle Mountain area - an area consisting of 388 square miles of hilly, wooded area, drains into the Souris River. This area is generally ten degrees colder daily than the Minot area and the net result is that our runoff water hits the ... about the time the Lake Darling and Minot waters ...

In 1976 we had 249,325 acres of farmland flooded ... level with 198,421 acres flooded for one week or more ... unable to crop 77,769 acres because of high water. ... that this was an unusual year. However, your 500 ... runoff, and one foot higher elevations can only ... from going into the Souris River for a prolonged ... and the 77,769 acres which was so unusual, can be ... year occurrence. Don't you think this area warrants ... study?

Corps Responses to C.R. Keller's Comments (16 December 1977)

1. Comment acknowledged. The economic, environmental, and social impacts are discussed in the final EIS.

2. See response 3 to your 15 December 1977 letter.

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3 The matter of mitigation acreage becomes a thorn - here are Bottineau and Renville Counties, both of which suffer severe economic impact, should Burlington Dam become a reality, being asked to allow further acreage to go into governmental hands for mitigation purposes. This seems rather ridiculous under the circumstances.

4 I believe it should also be pointed out that tax dollars are constantly being lost as property passes into governmental hands. At present the average tax rate is $2.00 per acre to private individuals while U.S. lands are presently averaging 5¢ per acre in lieu of taxes.

Sincerely,

C.R. Keller
411 Sinclair Street
Bottineau, North Dakota 58318

cc. E. Zell Steevor, Executive Office of the President
Quentin Burdick, U.S. Senator
Milton R. Young, U.S. Senator
Mark Andrews, U.S. Representative
Arthur Link, Governor of ND

[illegible] responses to C. R. Keller's comments

The Fish and Wildlife Service provided a list of 11,600 acres of drained wetlands from which 2,000 acres would be selected for mitigation. The 11,600 acres are located as follows: 1,560 acres in Renville County, 3,840 acres in Ward County, 1,040 acres in McHenry County and 5,160 acres in Bottineau County. The Service further recommended against selection of mitigation lands in Renville County since the county would receive no benefits from the flood control project.

In a recent letter, Mr. Harvey Willoughby, Regional Director of the Fish and Wildlife Service, recommended that the 2,000 acres be purchased where possible from willing sellers. Land should first be sought in the Souris River basin. After a reasonable time, if sufficient Souris River basin residents have not indicated a willingness to sell at fair market value, offers should be extended to owners of suitable mitigation lands located outside the designated area.

4. The Burlington Dam project has been modified to include the taking of flowage easements on lands above the 100-year pool in lieu of all fee title purchase. This would preserve the existing tax base, insuring farm productivity on approximately 4,000 acres of lands and reducing the number of family dislocations by about 25 in Renville County. An economic study has indicated that only a small percentage of the total taxable valuation in Renville County would be affected by the purposed Burlington Dam. Productivity losses in the reservoir area have been added to the cost of the project.

The 1969 flood in Minot reduced property assessments, resulting in a loss of $123,000 in taxes for the year 1970. Emergency measures have prevented severe flooding (and the loss of property valuation and taxes) since 1970. Thus, without the proposed Burlington Dam to hold and regulate the flow on the Souris River, severe property and resultant tax losses can still occur. Similarly, the 2,000 acres proposed for mitigation by the Fish and Wildlife Service would result in a small reduction in total tax valuation. However, the percentage effect on various political entities could not be determined until the acreage involved has been selected. Tax loss from mitigation lands must be compared with the tax loss prevented by the proposed project.

December 4, 1977

Colonel Forrest T. Gay, III
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Before addressing specific comments on the "DRAFT ENVIRONMENTAL IMPACT STATEMENT - FLOOD CONTROL - BURLINGTON DAM - SOURIS RIVER, NORTH DAKOTA" which is dated October 1977 I would like to point out that in a state where long-term preservation of environmental quality is increasingly "last & least" the project as proposed will most assuredly contribute to a degradation of environmental quality. Furthermore it should be emphasized that this project will contribute in a superb way to "short term economic gains for a few at the cost of long term environmental losses to future generations."

The following comments are addressed to specific topics & pages.

1 On page 7 reference is made to a flood having a chance of 0.04 per cent (i.e. one which would occur or might occur once in 2500 years). It needs to be emphasized that the standard approach as cited above in referring to flood frequencies is no longer valid because of a number of land use problems & practices which hasten run-off & contribute to flooding: (1) wetland drainage (both "legal" & "illegal"); (2) over-grazing of range & pasturelands; (3) breaking up & subsequent tillage of marginal & submarginal lands. There is an urgent need for recognizing that flooding problems are, at least in part, caused by land abuses.

2 On page 13 in reference to the DesLacs Diversion Tunnel many of us in the Minot area recall a statement attributed to one of the engineers in the St. Paul office of the Corps which essentially stated that the tunnel would be a marvelous "engineerin achievement," assuming of course that the tunnel is completed. Many of us have the feeling that the tunnel is essentially a "plaything of the Corps" at taxpayers' expense of course. I have visions of some remarkable cost-overruns for that phase of the project.

3 On page 15 Reference is made to mitigation to the province of Manitoba. Why were not these costs included in dollar figures? Or is the Corps afraid to list these costs? Or doesn't the Corps really know what these costs are?

4 On page 16 reference is made to a "flood warning system on Gassman Coulee." No cost figures are included. What exactly would a system like this cost? Or does the Corps really know? The utter inadequacy such as this in the event of flash floods caused by heavy rains makes the proposal laughable in a macabre way.

continued on page 2

Corps Responses to Dennis Disrud's Comments

1. See responses to comments made by the North Dakota State Geological Survey.

2. Comment acknowledged. No response necessary.

3. These costs are currently estimated at $500,000. (These costs are estimated and are dependent upon the International Joint Commission determinations and further negotiations between United States and Canadian governments.) See also pages 92 and 93 of the Phase I General Design Memorandum (GDM), which is available upon request from the St. Paul District Office.

4. The cost estimates in the Phase I General Design Memorandum (GDM) includes the annual operation cost of $32,000 for gages at various locations, including Gassman Coulee. Although not specifically stated in the GDM, the Corps has estimated the first cost of a gaging system on the coulee to be approximately $15,000. See also the responses to the comments made by the U.S. Department of Commerce, National Atmospheric Administration.

(a) The following comments are addressed to Table [illegible] The interest rate of 5 1/8 per cent is absurdly low. [illegible] Corps' own admission (11/2/77 Minot Daily News) if the interest [illegible] is increased to 5 1/4 per cent the benefit-cost ratio drops to 1.10. Considering the
5 incredible annual federal deficits of 50 plus billion dollars it is apparent that an interest rate of at least 5 1/2 per cent or more realistically 6 per cent must be used. If these more realistic [illegible] (5 1/2-6 per cent) are used what happens to the benefit-cost ratio? I think the answer is only too obvious. (b) In calculating benefits no specific itemization of these benefits is presented. How much of these benefits are attributed to future floodplain development following construction of Burlington Dam or would the Corps rather not reveal this figure? (c) In calculating costs no figures in dollars are given for the cost of land acquisition. No figures are given as to acres to be purchased by fee title. (d) No figures are given as to cost of flowage easements. In terms of fish & wildlife losses & mitigation costs - what are the costs of acquiring those 2000 acres or would the Corps rather not reveal that figure or doesn't the Corps know? (e) A further glaring inadequacy is the fact that no figures are given in dollars for recreational fishing at Baker Bridge, St. Mary Bridge, & Lake Darling. The loss of a high quality recreational fishery MUST be calculated as a cost of the project. What about the losses as costs of the project in terms of [illegible] production? Surely there must be approximate figures available [illegible] species composition (beaver, mink, weasel, [illegible]) & dollar yield [illegible] for that part of the Souris & DesLacs valleys to be affected by [illegible] project. No costs of the loss of the whitetail deer herd are given. [illegible] must be figures available on the estimated number of hunters [illegible] to be affected, number of deer harvested, etc. For those who have hunted deer on both private & public lands to be affected & who [illegible] high quality hunts we wonder how the Corps can avoid [illegible] in those losses. What about calculating the actual dollar loss [illegible] fowl production? No figures are given for this cost or loss. [illegible] number of people in the Minot Area (& visitors from out-of-state) [illegible] do not fish, hunt, or trap derive a great deal of recreation in the form of bird watching & nature photography in the area to be affected. No numbers [illegible] given in terms of costs (losses) to those who would lose these opportunities. In summary the Table (1) on page 1? is best described as "TOTALLY INADEQUATE."

6 On page 32 statements are made in regard to the city of Minot dumping their sewage lagoons. It must be emphasized that the statement "coinciding with the higher flows in the receiving waters" in reference to sewage effluent release is at best a partial truth. The lagoons are drained when full regardless of the time of year & regardless of downstream consequences as evidenced by the ecological fiasco of this past summer when Minot's sewage effluent was in large measure responsible for the outbreak of botulism at J. Clark Salyer National Wildlife Refuge.

7 On page 43 in reference to the drainage fiasco [illegible] watershed. When wetland drainage occurs how can you [illegible] this [illegible] no significant effect on Souris River flood flows? Do you have proof of this?

8 On page 43 in reference to the [illegible] Valley [illegible] general understanding in the Minot area is that the construction of the [illegible] Dam would in

continued on page 3

Corps Responses to Dennis Disrud's Comments

5. The table shown in the EIS is a summary table. More detailed information on the project costs can be found in the tables shown on pages 69-74 of the Phase I GDM.

5a. The Minot channel project and the Burlington Dam are both portions of the overall project to provide adequate flood control. Future flood events and flood damages should be the same for both the channel and the reservoir. If discount rates for stating average annual damages and benefits (damages prevented) differ for evaluating interdependent and co-existing projects, different values of the annual equivalent series would be computed for the same future floods. Since the Minot channel project was evaluated at a Federal discount rate of 5 1/8 percent, the Burlington reservoir has been evaluated at the same rate. However, the benefit-cost ratio for the Burlington Dam project at the current Federal discount rate of 6 5/8 percent is 1.06, indicating economic feasibility.

5b. Itemized computations of damages and benefits for the Burlington Dam project are shown in the economic appendix of the Phase I General Design Memorandum, December 1977. The project is feasible without the future growth of benefits at the 5 1/8 percent discount rate. Future benefits add about 20 percent to the benefits calculated for existing conditions.

5c. Real Estate Above Dam - At full pool elevation 1620, which would be reached on an average of less than once every 2,500 years, approximately 25,500 acres would be inundated, of which a total of about 19,500 acres is in the Upper Souris National Wildlife Refuge, presently in Federal ownership. The remainder, 6,000 acres, is in private ownership.

Local interests are opposed to the removal of private lands from the tax base and the relocation of residences from the reservoir area. The State of North Dakota expressed its concern in a letter which proposed permitting residents to remain above the 100-year frequency elevation. Thus, the proposed plan provides for fee title purchase of lands required for project structures and lands upstream from Burlington Dam to the 100-year frequency elevation, presently established at 1605 above Lake Darling Dam and 1602 between Burlington Dam and Lake Darling Dam. Flowage easements would be taken between the 100-year frequency elevation and elevation 1620 with human habitation permitted and including the right to erode and prohibit future construction. Lands to be taken in fee title include approximately 7,070 acres within the design pool and 4,220 acres of uneconomic remnants above the design pool level. Approximately 2,920 acres of private lands are in the flowage easement area of the reservoir. The plan includes the purchase of about 30 sets of buildings in the reservoir area including 18 farms and 12 nonfarm residences.

all likelihood facilitate the implementation of this scheme.

9 On page 64 the question of how many houses have been constructed in the so-called 100 year flood plain since 1969 is not answered. The question is in need of an answer.

10 On page 71 no attempt is made to place a value on recreational fishing for the affected area. In the event that Burlington Dam is built & used some dollar value needs to be provided as to the effect on the local economy the elimination of recreational fishing at Barker Bridge, St. Mary Bridge, & Lake Darling would have. Perhaps the Corps is afraid to perform these calculations.

11 (a) On page 84 reference is made under section 4.10 to "channel scour & bank stability are recognized as possible local problems following storage of a major flood." Are these possible costs to be borne by the 'bleeding' middle class taxpayer? Certainly some value needs to be included as a cost in calculating benefit-cost ratios. (b) Under section 4.11 you state "The projects would not, however, significantly deplete the regional supply of these materials. The projects would have no effect on the production & future development of lignite, oil or gas." Considering the recent oil wells which have been placed in production on the west side of Lake Darling this question needs to be answered in a much more reliable way (the question being how reliable are the data on potential fossil fuel resources for the area to be affected?). Your assurances do not satisfy the need for an adequate answer.

12 On page 87 the statement is made leading off section 4.23 "During years requiring storage behind Burlington Dam itself (less than twice in 100 years on the average)......" It should be emphasized that from 1969 to the present the dam would have been used three times. Your statement is fundamentally a gross mistruth.

13 In reference to Bottomland Hardwoods on page 91 & following you state that approximately 1400 acres would be lost. When this is added to the losses (proposed) of Corps proposals in the bottomland hardwoods of the Missouri, Park, Pembina, Sheyenne, & [illegible] State of North Dakota rivers one wonders if the Corps has any concerns (gives a damn) for the environment other than for its mania (& [illegible] its supporters) for building dams.

14 On pages 93 & 94 comments are raised on weed control problems if Burlington Dam is built. Who is to pay for [illegible] costs? Are these possible costs figured into the benefit-cost analysis for the project? How much would these costs amount to? Or is the Corps figuring this as a benefit since the local agrochemicals distributors would undoubtedly have or receive a tremendous boost in sales of herbicides?

15 On pages 96, 97, & 98 concern is voiced about carp introduction if Burlington Dam is built. What is the probability of this occurring? If carp are introduced or if their introduction is to be prevented what are the costs in dollars? Why is this not figured into the benefit-cost analysis? What value is placed on waterfowl [illegible] of between 6,400 & 22,400 annually?

continued on page 4

Corps Responses to Dennis Disrud's Comments (cont.)

Renville County Memorial Park is in a loop of the Souris River about 2 miles north of State Highway 5 and, except for some county-owned property, is privately owned. About 120 separate ownerships are in the park including 80 cottages, a few of which are permanent residences, and county-owned recreation buildings. The average elevation of the park is about 1600 feet above msl. Accordingly, the plan provides for fee title purchase of all lands and developments within the park.

Real Estate Below Dam - Included in the real estate plan for the dam is the acquisition of flowage easements on about 1,800 acres of farmlands in a 6-mile reach between Towner, North Dakota, and the J. Clark Salyer Refuge. Justification for the easements is based on the induced flooding that would occur periodically during the summer when it would be necessary to evacuate reservoir storage.

Costs - A summary of the estimated first costs of project features is shown on pages 69-71, of the Phase I General Design Memorandum.

5d. The estimated total cost for flowage easements is $7,782,000. A summary of the estimated first costs is shown on pages 69-72 of the above referenced Phase I GDM. The estimated costs for acquisition and restoration of 2,000 acres of wetlands is $1,380,000. This information is also shown in the above referenced table.

5e. The method of calculating the economic values of existing fisheries and wildlife resources in terms of the value of each user-day was not used in assessing the impacts of the proposed project. An alternate evaluation method was used. As stated in paragraph 4.107 of the final EIS, in July 1975 the Corps entered into an agreement with the U.S. Fish and Wildlife Service (FWS) to quantify fisheries and wildlife losses in terms of habitat units. The evaluation system that was used is the Habitat Evaluation Procedures (HEP) which was developed by the USFWS. The losses incurred by the recreational fishery, furbearer, upland game and big game production, subsequent hunter harvests, aesthetic losses, and nonconsumptive uses are discussed in the narrative of the impact statement.

6. The section cited which addressed "Sources of Pollution" has been revised in the final EIS in accordance with information obtained from the North Dakota State Department of Health. It should be recognized that these systems are not infallible and breakdowns have occurred in the past; however, when these systems operate properly, untreated wastes are not discharged into the Souris River.

16 On page 99 it is [illegible] that some value be [illegible] s [illegible] utilized in section [illegible]. Why is this not done?

17 On page 100 under "Disease Vectors" in section 4.63 who [illegible] for the increased costs of mosquito control a [illegible] the Darlington Dam if it is built? This must be calculated as a cost of the project or in the Corps figuring this as a benefit since it would [illegible] result in increased sales of insecticides.

18 On page 101 under sections 4.66 & 4.67 I presume you are attempting to calculate some sort of grossly inflated benefit for temporary alleviation of unemployment such as at the end of section 4.67 "It might be expected that many of the unemployed workers in the area would seek employment connected with the construction of the project." In further reference to sections 4.66, 4.67, & 4.68 it is only too apparent to many of us that two of the major beneficiaries will be Peterson Excavating & Bechtold Excavating.

19 On page 101 under section 4.69 who besides the 'bleeding' taxpayer is going to pay for "an under-utilized but costly service structure which the local residents must pay for through higher taxes?" This is most assuredly a cost of the project which must be figured into the benefit-cost analysis.

20 On page 110 under section 5.09 you state that the Fish & Wildlife Service controls operating procedures of Lake Darling. I frankly doubt this & don't believe that statement. The Corps has "called the shots" on operating Lake Darling during floods in the past (either directly or indirectly) & there is no reason to believe that the future will see a change in this policy.

21 On page 120 negative comments are made on the Lake Darling alternative in spite of the favorable benefit-cost ratio. The logic is weak & little short of incredible. Better & more detailed [illegible] must be forthcoming.

22 A criticism of the environmental impact statement in general is that it continues the old game of playing down costs & playing up the benefits. This is accomplished again in the grand manner by a play on vague terms such as "significant" - significant according to whom??????

The personnel responsible for putting together this environmental impact statement are to be congratulated for writing a statement which does nothing to detract from the incredibly low credibility rating that the Army Corps of Engineers now enjoys among the informed citizenry. One wonders if there isn't also a rather large cost-overrun in the making which should enhance the above.

Finally, the scandalous practice of agencies which promote & sponsor so-called water development projects writing their own environmental impact statements & computing their own benefit-cost ratios MUST COME TO AN END.

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Corps Responses to Dennis Disrud's Comments (cont.)

7. The cited section in the draft EIS states that the two small dams and the channel modification do not have a significant effect on Souris River flood flows. There was no intention of inferring that wetland drainage has no effect on the Souris River flood flows. See also the response to comments by the North Dakota State Geological Survey and State Geologist in the final EIS.

8. The North Dakota State Water Commission has verified the statement in the draft EIS as factual. The implementation of the proposed plan should have no effect on a decision whether or not to construct the Tolley Flats project.

If you have any questions on my comments feel free to contact me.

Sincerely,

Dennis T. Disrud

Dennis T. Disrud, Ph.D.
Environmental Consultant
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cc. Mr. Richard Backes
Glenburn, North Dakota 58740

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707 S.W. 12th
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Mr. Jon Malcolm
Manager, Clark Salyer National Wildlife Refuge
Upham, North Dakota 58789

Mr. Lloyd Nygard
RR 6
Minot, North Dakota 58701

Mr. Stanley Saugstad
RR4
Minot, North Dakota 58701

Mr. Russell Stuart
Commissioner
North Dakota Game & Fish Department
Bismarck, North Dakota 58505

Mr. M. B. Wright
Manager, Upper Souris National Wildlife Refuge
Foxholm, North Dakota 58738

Corps Responses to Dennis Disrud's Comments (cont.)

9. Our records indicate about 50 residences and about 10 commercial structures have been constructed in the Souris River floodplain between Burlington and Sawyer (including the city of Minot) since 1969. About 82 older homes in the city of Minot have been demolished since 1969. During the period from 1957 to 1966, residential land use in the Minot floodplain increased at a rate of about 6 percent per year. Since 1969 there has been a small net decline in the number of residences on the floodplain.

10. See response to comment 5e.

11a. Some increased channel erosion would occur during summer months of those years when it would be necessary to empty the reservoir. However, on the whole, it is expected that erosion would be decreased since highly erosive spring flows would be reduced to below 5,000 cfs. Therefore, no costs were included in the project cost estimates for erosion protection except in protected urban reaches where existing channel banks would be disturbed.

11b. This statement was made after consulting with professional geologists and was based upon the best information available. Sources within the petroleum industry have indicated that oil and gas deposits underlying floodplain lands can be tapped by means of lateral drilling.

12. Based on the Corps estimates, a flood having less than a 2 percent chance of occurring during any one year (50-year flood) would require no storage behind Burlington Dam. All floods smaller than the 50-year flood would be regulated by the storage provided by the raised Lake Darling Dam. This includes all floods since 1969 except the 1976 flood which the Corps has estimated to be about a 75-year flood. Thus, based on our best estimate, the Burlington Dam would have been used only since 1969.

13. Comment acknowledged. We feel that the impacts on bottomland hardwoods have been recognized in the EIS. See also the section addressing aesthetics which has been added to the final EIS.

14. The project cost estimate includes the amount of $120,000 for annual weed control. The costs would be borne by the Federal government and are included in the computation of the benefit-cost ratio (as a project cost).

15. It is expected that the increased flows from the reservoir during the summer months may increase the probability of carp being introduced into the United States portion of the Souris River. The probability of this occurring cannot definitely be stated at this time. The project includes costs of $115,000 for facilities on Dam 375 in the J. Clark Salyer Refuge to prevent the upstream movement of carp. This amount is included in the benefit-cost

ratio. Waterfowl losses should not occur if the facilities are successful in preventing the upstream migration of carp. These facilities will be designed using the best available technology to insure that these measures are successful. Thus, no values for waterfowl losses were used in calculating the benefit cost ratio.

16. See response to comment designated 5e.

17. In view of the infrequent use of storage behind the Burlington Dam, the cost, if any, is considered negligible or within the contingency allowance of the project.

18. The project economic analysis includes a local employment benefit amounting to $247,000 annually (this information can be found on page 76 of the Phase 1, General Design Memorandum). Government contracts are open to all qualified bidders. The cited contractors if qualified would be eligible to enter into competitive bidding with all other eligible bidders.

19. The last sentence in the cited paragraph answers the comment. This is not expected to happen in Minot.

20. The U.S. Fish and Wildlife Service is solely responsible for the operation of Lake Darling by Act of Congress. However, we have coordinated the operation of Lake Darling with the Service during the recent major flood years, in connection with the Corps emergency activities in Minot and other areas along the Souris River.

21. As indicated in the EIS a dam at the Lake Darling site would be more economical and less environmentally damaging than a dam at the Burlington site, but was not selected because of the degree of protection.

22. Comment acknowledged. No response necessary.

[illegible] AND LITERATURE CITED

[illegible] ground-water conditions at Minot, North [illegible] State Water Commission, Ground Water Studies [illegible]

[illegible], 19[illegible]. Ground water in the Mohall area, Bottineau and Ren[illegible] Counties, North Dakota. North Dakota State Water Commission, Ground Water Studies No. 17.

[illegible], S.B., and D.E. [illegible]sen, 1957. Halite deposits in North Dakota. North Dakota Geol. Surv., Report of Investigation No. 28.

Armstrong, [illegible], [illegible]. Geology and ground water resources of Burke and [illegible] Counties. North Dakota Geo. Survey, Bull. 55, Parts II and III.

[illegible], W.[illegible], [illegible] Carlson, and J. Kume, 1960. Subsurface geology and development of petroleum in North Dakota. North Dakota Geol. Surv., Bull. [illegible]

[illegible] bedrock in North Dakota (Preliminary). North Dakota Geol. Surv., Misc. Map No. [illegible]

Bl[illegible], [illegible] map of bedrock surface of North Dakota (preliminary). North Dakota Geol. Surv., Misc. Map No. 12.

Carlson, C.G., 1969. Bedrock map of North Dakota. North Dakota Geol. Surv., Misc. Map [illegible]

[illegible], 19[illegible]. Geology and ground water resources, Divide County, North Dakota, Parts I, II, & III. North Dakota Geol. Surv., [illegible]

[illegible], [illegible] survey of Southeastern wildlife and wildlife-[illegible]. Trans. No. Amer. Wildl. Conf. 39:187-194.

Hut[illegible], R.D., and [illegible] A. Pettyjohn, 1971. Ground water resources of Renville and Ward Counties. North Dakota Geol. Surv., Bull. 50, Parts II and III.

[illegible] Garrison Diversion Study Board, 1976. Report to the International Joint Commission. Appendix C, Biology Report. 392 pp.

J[illegible], H.M., 196[illegible]. Geology and occurrence of ground water near Bowbells, Burke and Ward Counties, North Dakota. North Dakota State Water Comm., Ground Water Studies No. 42.

[illegible], [illegible]. Aquatic Weed Decay: Dissolved Oxygen Utilization and Nitrogen and Phosphorus Regeneration, Journal WPCA 43:7, 457.

[illegible], [illegible], [illegible], and J.B. Smith, 1972. Strippable lignite reserves [illegible]: location, tonnage, and characteristics of lignite [illegible] Bureau of Mines, Information Circular 8537.

Kuchler, A.W., 1964. Potential natural vegetation of the conterminous United States. American Geographical Society, New York.

Laird, W.M., 1957. Guidebook for geologic field trip in the Minot area, North Dakota. North Dakota Geol. Surv., Misc. Series No. 2.

Lemke, R.W., 1960. Geology of the Souris River Area, North Dakota. U.S. Geol. Surv., Prof. Paper 325.

Lunan, J.A., T. Glorvigen, and G. Leslie, 1973. Biological and recreational impacts of nine proposed flood control alternatives in the Des Lacs and Souris River floodplains, North Dakota. Contract No. DACW 37-73-C-0001. U.S. Army Corps of Engineers, St. Paul District, St. Paul, Minnesota.

Mitich, L.W., (undated). Identifying weeds and their seeds. North Dakota State University, Cooperative Extension Service. Crop Judging Circular No. 3.

North Dakota Agricultural Experiment Station, 1968. Soil survey report, county general soil maps. Bulletin No. 473, North Dakota State University.

North Dakota Geological Survey, 1976. North Dakota Geological Survey map of oil pools in North Dakota.

North Dakota Geological Survey, 1976. Official oil production statistics in North Dakota, first half 1976.

Odum, E.P., 1971. Fundamentals of ecology (3rd Edition), W.B. Saunders Co., Philadelphia.

Pettyjohn, W.A., 1967. Geohydrology of the Souris River valley in the vicinity of Minot, North Dakota. Geol. Surv., Water Supply Paper 1844.

Pettyjohn, W.A., 1967. Multiple drift sheets in southwestern Ward County, North Dakota. In Glacial geology of the Missouri Coteau and adjacent areas. 1967. North Dakota Geol. Surv., Misc. Series No. 30, pp. 122-9.

Pettyjohn, W.A., 1968. Design and construction of a duel recharge system at Minot, North Dakota. National Water Well Assoc., Ground Water, vol. VI, No. 4.

Pettyjohn, W.A., 1970. Preliminary report on the ground water conditions in the vicinity of Minot, North Dakota. Published by the city of Minot.

Simpson, H.E., 1929. Geology and ground water resources of North Dakota. U.S. Geol. Surv., Water Supply Paper 598.

Sylvester, Robert O. and Seabloom, Robert W., 1965. Influence of Site Characteristics on Quality of Impounded Water, Journal AWWA.

Stanley, L.D., and G.R. Hoffman, 1974. The natural and experimental establishment of vegetation along the shoreline of Lake Oahe and Lake Sakakawea, mainstem Missouri River reservoirs. University of South Dakota, Vermillion, South Dakota.

Stanley, L.D., and G.R. Hoffman, 1975. Further studies on the natural and experimental establishment of vegetation along the shoreline of Lake Oahe and Lake Sakakawea, lakes of the mainstem Missouri River. University of South Dakota, Vermillion, South Dakota.

Stewart, R.E. and H.A. Kantrud, 1973. Ecological distribution of breeding waterfowl populations in North Dakota. J. Wildlife Management 37(1): 39-50.

Ulrich, R.A., and F.K. Pfeifer, 1976. Limnol ogical survey of the Souris River and it major tributaries in North Dakota. U.S. Fish and Wildlife Service, Bismarck, North Dakota. 75 pp.

U.S. Bureau of Mines. Minerals Yearbook, 19691 The Mineral Industry of North Dakota.

U.S. Coast and Geodetic Survey, 1969. Seismic risk map.

U.S. Fish and Wildlife Service, 1976. An evaluation of the impacts caused by the Garrison Diversion Unit on national wildlife refuges in North Dakota. Bismarck Area Office. 113 pp.

Wilson, J.A., and R.Q. Landers, 1973. Plant species and wildlife cover and erosion control on "mudflats" in Iowa's large reservoir systems. Iowa State Water Resources Research Institute. Ames, Iowa.

Workmen's Compensation Bureau, 1975. North Dakota annual coal mine report, July 1, 1974-June 30, 1975.

TECHNICAL

APPENDIX

ST. PAUL DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

FINAL
ENVIRONMENTAL IMPACT STATEMENT
FLOOD CONTROL
BURLINGTON DAM
SOURIS RIVER, NORTH DAKOTA

TECHNICAL APPENDIX
TABLE OF CONTENTS

DESCRIPTION OF HABITAT EVALUATION PROCEDURES METHODOLOGY

The Habitat Evaluation Procedures (HEP) were adapted by the USFWS from an earlier version of the procedures (EPEP) developed by the National Coordinating Committee for Fish and Wildlife Conservation in Federal Water Development Programs. The HEP were the result of an effort to identify in non-monetary terms the fish and wildlife resources in an area and to evaluate probable impacts on them that would result from water resource development projects. A quantification of those impacts is required under Principles and Standards for Planning Water and Related Land Resource Projects developed by the Water Resources Council. A non-monetary method was developed because the value of most wildlife cannot be accurately quantified in terms of hunter and fisherman days, the traditional approach used to assess benefits and losses resulting from a proposed project.

The description of the HEP that follows is a general outline of the steps followed in the Burlington Dam study:

1. A team of biologists, familiar with the area and representing Federal, State, and construction agencies, is formed.

2. Habitat type maps are prepared of the project area from large-scale aerial photographs.

3. Team members develop a list of up to 10 wildlife species representative of each habitat type present in the project area. Also, for each species a list of evaluation criteria is developed so that for each habitat type, the habitat can be rated on a scale from 1 to 10 on its ability to support each species.

4. The habitat unit value (HUV) for each habitat type is the sum of the values from 1 to 10 for each species, i.e., the HUV for any habitat range from 10 to 100.

5. The total habitat units (HU's) for each habitat type in the project area is a product of the type's HUV and the acres of that type present in the area.

6. Changes in existing HU's are projected over time for the project area for both "with" and "without" project conditions. Factors considered in these projections are land use changes, ecological succession, flood storage, changes in flooded areas downstream, physical loss of habitat due to construction features, etc.

7. The difference in HU's between "with" and "without" project conditions over the life of the project is divided by the period of analysis in years (in this case, 100 years) to determine the average annual loss or gain of HU's resulting from project implementation.

8. The amount of land necessary to replace HU losses is determined by dividing the HU's lost by the difference between the HUV of the replacement lands and 100 (the difference represents the assumed maxmum management potential).

EXHIBIT 1

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

P. O. Box 1458, Bismarck, North Dakota 58501

February 22, 1977

Colonel Forrest T. Gay
District Engineer
Corps of Engineers, St. Paul District
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

We are forwarding the following material in reply to your request for information on prime and unique farmlands in the Burlington Dam flood control project area on the Souris River, North Dakota:

1. No unique farmlands have been identified in the project area.

2. A copy of the Ward County Soil Survey is attached. The prime farmlands have been identified and colored blue on map sheets 25, 26, 27, 35, 36, 37, 45, 46, 55 and 56.

3. Copies of the soil survey field sheets of Renville County (this survey has not been published as of this date) with the prime farmlands colored in blue.

We do not have a detailed soil survey of McHenry and Bottineau Counties; however, the general soil map indicates the soils in the vicinity of the J. Clark Salyer Refuge are either too sandy or too wet to be in the prime or unique categories.

Sincerely,

Allen L. Fisk
State Conservationist

Attachments

cc: Abner Lee, AC, SCS, Minot, ND w/o attachments

Exhibit 2

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Area Office - North Dakota
1500 Capitol Avenue
P. O. Box 1897
Bismarck, North Dakota 58501

APR 25 1977

Colonel Forrest T. Gay, III, District Engineer
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

This letter documents our analysis of the impacts of your recommended plan of development for Burlington Dam and Reservoir on the Souris River, North Dakota, and submits our recommendations for measures to mitigate adverse effects of the proposed development on terrestrial wildlife habitat. Although expected adverse impacts of the project on aquatic habitat are discussed narratively, no satisfactory method has been developed to quantify these losses. Measures to mitigate aquatic habitat losses may be made at a later date after additional studies are conducted. Other aspects of the flood control plan for the Souris River Basin are not addressed in this letter. Our recommendations for flow releases and structural modifications necessary to safeguard the integrity of Upper Souris and J. Clark Salyer National Wildlife Refuges were furnished earlier and have been incorporated in the basic flood control plan. The recommended habitat mitigation plan should be incorporated in your Phase I General Design Memorandum and all succeeding planning documents.

This planning aid letter is to assist your planning in post-authorization studies and is submitted under the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and the conclusions and recommendations contained herein constitute the official position of the Fish and Wildlife Service on the matters covered. The North Dakota Game and Fish Department concurs with our project analysis and recommendations, as indicated in the attached copy of a letter dated April 12, 1977, from Commissioner Russell W. Stuart. The two suggestions made by Mr. Stuart have been incorporated in our recommendations. All previous reports and letters recommending fish and wildlife compensation measures, not based on the current plan, may be considered invalid. Engineering and hydrological data on which our analysis of project effects is based were received in several parcels, the latest transmitted by letter dated February 4, 1977. The assistance provided by your staff throughout the course of this study has been very much appreciated.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Exhibit 3

The project area includes the entire Souris loop from the Saskatchewan border to the Manitoba border. From the Burlington Dam site to Saskatchewan, the area of influence is defined by the 1,620-foot msl contour, the design maximum pool level of Burlington Reservoir. Downstream from Burlington Dam, the area of influence is the Souris River flood plain. In the Souris River Valley, grassland (which predominates on the surrounding uplands), forest, and marsh communities are situated along the river channel. This complex of vegetation is scarce in North Dakota where prairie predominates. The fish and wildlife species indigenous to an area are a response to the vegetation present. The fish and wildlife diversity of the Souris River Valley is high when compared to surrounding areas.

The principal features of the flood control plan include a dam at the Burlington site, a 4-foot raise of Lake Darling Dam, and modification of dikes and control structures of the several marsh units at Upper Souris and J. Clark Salyer Refuges. Other features of the plan include a tunnel diversion to carry flood flows on the Des Lacs River to the Souris River above Burlington Dam, levees at Velva and Sawyer and in urban areas between Burlington and Minot, and clearing and snagging in certain downstream reaches of the river. Another potential feature of the plan is a dam on Gassman Coulee which empties into the Souris River just above Minot. A separate but integral part of the overall flood control plan is the 27.7-mile channel project from Burlington to Logan. The purpose of this project, now 75 percent complete, is to provide Minot with a 5,000 cfs capacity channel.

Burlington Dam, authorized by the Flood Control Act of December 31, 1970, will have a capacity of 672,000 acre-feet of flood storage space, with no conservation pool. At design pool elevation of 1620, the pool would extend upstream to the Saskatchewan border. The spillway crest elevation of Lake Darling Dam will be raised from 1598 to 1602, thus providing 93,000 acre-feet of flood storage space. With 3 feet of surcharge, there would be 134,000 acre-feet of flood control storage in Lake Darling.

The operating plan envisions storing lesser and intermediate floods in Lake Darling. Lake Darling would be drawn down to elevation 1594 prior to floods. Floods of up to about the 50-year flood could be stored in Lake Darling without Burlington Dam going into operation. When Lake Darling Dam is unable to restrict flows at Minot to 5,000 cfs, Burlington Dam would go into operation. For very large floods, the Burlington pool would back water up to and over Lake Darling Dam. When this occurs, the two pools would be drawn down concurrently until the Lake Darling pool reaches 1598. At that point, the Fish and Wildlife Service would have the option of drawing down to 1596, the normal summer operating level, if desired, or holding at the 1598 level. Whether for the larger floods stored in Burlington or the smaller floods stored solely in Lake Darling, the adopted release plan is to release a maximum of 5,000 cfs at Minot until May 15. Then flows will be cut back to the inflow recession until recession reaches 500 cfs, at which time reservoir releases will be maintained at 500 cfs until about September 1, when the release is increased to 700 cfs

until the flood pool is evacuated. For floods less frequent than 200 years, larger summer and fall flows would be required to empty the reservoir by the following spring.

There are several features of the flood control plan that have not been evaluated from an environmental standpoint. They include the direct impacts of construction and operation of the Des Lacs Diversion Dam and tunnel, construction of levees in urban areas downstream from Burlington, and the proposed dam on Gassman Coulee. It is our understanding that detailed engineering data on these features will not be finalized until March 1979, the scheduled completion date of the Phase II General Design Memorandum. Mitigation needs attributable to these project features are not known at this time. Also, details of the land requirements for the project are not known at this time. Possible values that might be associated with fee title project lands cannot be ascertained until their exact location is known, nor can recommendations be made concerning management of these lands.

Assuming that some project lands will be acquired in fee title that may be suitable for management under a General Plan by either the North Dakota Game and Fish Department or the Fish and Wildlife Service, we take this opportunity to advise you of a recent opinion of the Deputy Solicitor, Department of the Interior. That opinion basically states that commitment of project lands to fish and wildlife management under a General Plan is a major federal action that may have a significant impact on the quality of the human environment. Compliance with the National Environmental Policy Act therefore, in his opinion, requires preparation of an environmental impact statement or at least an environmental assessment for such an action unless the General Plan lands are described in the project EIS. We advise you of this opinion at this time so that your staff can consider the matter as they prepare an EIS on the Burlington project.

From a fishery standpoint, the most unique feature of the Souris River is that it is one of the few remaining carp free waters of the United States. To date, 26 species of fish have been collected from the stream, which includes the 9,900-acre Lake Darling and the several marsh units on Upper Souris and J. Clark Salyer Refuges. Northern pike and walleye are the most important game fish, while yellow perch, black bullheads, and white suckers are the common nongame species.

Lake Darling is one of the most popular fishing areas in North Dakota. It is especially noted for its large northern pike, many of which exceed 20 pounds in weight. A creel census conducted in 1971 revealed that Lake Darling provided 52,983 angler-days of sport fishing. The Souris River within the confines of Upper Souris and J. Clark Salyer Refuges furnishes about 15,000 man-days of fishing annually. Although no data are available as to the numbers of man-days of fishing that occur in the river outside the refuges, it is known that considerable fishing takes place near Minot and other towns along the river.

In terms of acreage, the flood plain forest is the smallest plant community in the Souris loop. However, the importance of this community far outweighs its relative abundance. North Dakota ranks nearly last out of the 50 states in total acreage of woodlands, with only about 400,000 acres of forest community. The 7,950 acres of forest along the Souris loop represent over 1 1/2 percent of the state's total woodland acreage.

The forest community is characterized by a wide variety of songbirds, upland game birds such as pheasants, and several species of mammals including squirrels, cottontails, raccoons, beaver and white-tailed deer. Many species of birds are dependent upon the forest for nesting, others for migration habitat, and others for winter food and cover. The high deer population of the Souris River Valley is a reflection of the large acreage of high quality flood plain forest. Even though this habitat may not be heavily used by deer during all seasons, it is of vital importance to the population for protective cover and food during severe winters.

Marsh habitat in the Souris River Valley is of national importance. Most of the marsh is on Upper Souris and J. Clark Salyer National Wildlife Refuges in a series of pools impounded by low dikes. The remainder is in the form of shallow river oxbows and wet meadows scattered throughout the valley. The primary purpose of the refuges is to attract, provide sanctuary for, and produce waterfowl. They constitute major units in a series of waterfowl refuges in the Central Flyway. Annual production of ducks and Canada geese averages about 6,000 and 150, respectively, at Upper Souris Refuge and 24,000 and 250, respectively, at J. Clark Salyer Refuge. Tremendous numbers of waterfowl concentrate on the refuges during spring and fall migrations and in the summer as young birds and moulting adults move in from surrounding areas. A large variety of water and shore birds use the refuge marshes during migrations, with many remaining to nest. In addition to the more common species of waterfowl, the Souris River (primarily on J. Clark Salyer Refuge) furnishes the only known hooded merganser nesting habitat in North Dakota, provides excellent wood duck habitat, and is the location of the only verified black duck and sandhill crane nesting in the state.

Mammals commonly associated with the marsh are beaver, mink, raccoon, muskrat, red foxes, and skunks. These furbearers provide an increasingly valuable resource for man as pelt values continue to rise. The marsh also provides valuable winter cover for deer and pheasants.

The grassland community is the most abundant type in the Souris River Valley and is found on the flood plain, particularly downstream from Minot, and on valley slopes throughout the Souris loop. Privately owned grassland is used for pasture and hay, both tame and wild. Inside refuge boundaries, it is managed for wildlife with grazing and haying used only as tools to improve habitat.

Upland game birds inhabiting the grassland community are pheasants, sharptailed grouse, and Hungarian partridge. Waterfowl use the grass-

lands for nesting and feeding. Several species of sparrow, the western meadow lark, upland plover, and horned lark are plentiful. Predatory birds such as marsh and Swainson's hawks are commonly found. A total of 262 species of birds have been recorded on or near the Souris loop refuges.

Herbivores are abundant in the grasslands. They are represented by several species of small rodents, white-tailed jackrabbits, and deer. Other species of common mammals include skunks, red fox, weasels, and badgers.

The acreage of cropland in the Souris River Valley is relatively small and is devoted primarily to the production of small grains and alfalfa. The principal value of cropland to wildlife in the Souris River Valley is the food it provides and nesting cover. Grain fields furnish green browse for geese in the spring and waste grain for ducks and geese during the fall.

The Habitat Evaluation Procedures were used to evaluate impacts of the project on terrestrial habitat. No comparable method has been developed to measure impacts of the project on aquatic habitat. Terrestrial habitat impacts were determined by utilizing the following procedure: 1) the river was divided into seven segments (Segment 1-Saskatchewan border to upper end of Lake Darling, Segment 2-upper end of Lake Darling to Lake Darling Dam, Segment 3-Lake Darling Dam to Baker Bridge, Segment 4-Baker Bridge to Burlington Dam, Segment 5-Burlington Dam to Logan, Segment 6-Logan to J. Clark Salyer Refuge, Segment 7-J. Clark Salyer Refuge); 2) acreages of habitat by contour interval were determined within segments; 3) hydrological data were assembled; 4) current value of existing habitats were measured; 5) quantitative relationships between hydrological data, vegetation changes and impacts on wildlife were determined; and 6) relationships in (5) were measured to determine "future without the project" and "future with the project" habitat conditions. Project impacts on terrestrial habitat were thus determined for Segments 1 through 4. It subsequently proved infeasible to apply the complete procedures in Segments 5 through 7. In these segments, project impacts were determined by applying value judgments to available data.

The following paragraphs will narratively describe expected project impacts on aquatic habitat and fishery resources, terrestrial habitat, and then present a summary of terrestrial habitat unit losses ascertained by the Habitat Evaluation Procedures.

Construction and operation of Burlington Dam will have adverse effects on the Souris River between Burlington and Lake Darling Dams. During periods of full storage, 26 miles of free-flowing river habitat will be lost. Reduction of the river's ability to assimilate organic wastes through re-aeration will alter its self purification properties during storage. Certain changes in the chemical composition of the water can be expected to occur with storage of flood waters. This includes, through retention, an increase of nutrients which could stimulate the production of undesirable, blue-green algal blooms. Should such blooms occur, they would have an adverse impact on water quality that could

affect downstream municipal and agricultural uses, as well as lowering biological productivity of the river.

Inundation of terrestrial vegetation in the Burlington pool would result in an unstable river bank, with a subsequent increase in siltation of the channel due to the settling action of the pool. This increased siltation would reduce both numbers and species diversity of invertebrates. Such an alteration of the invertebrate community would have a negative impact on fish, especially forage and young-of-the-year game fish, as well as waterfowl which utilize invertebrates as food.

Operation of either Burlington or Lake Darling Dam for flood control will cause an unstable shoreline. Fluctuating shorelines will be deleterious to aquatic plants and animals, including loss of littoral fauna and resultant reduction in numbers and growth of fishes.

Operation of the two dams will hamper the reproductive success of northern pike and walleyes. Flooding of terrestrial vegetation during the spring will encourage northern pike spawning; however, the timing of the reservoir drawdowns will be such that hatching of eggs or survival of fry is not likely. The expected increase in siltation is expected to decrease walleye reproduction. Fisherman use between the two dams will be greatly reduced during periods when water is stored in Burlington Reservoir.

Carp presently exist in the Souris River in Manitoba, while at the same time the Souris River in North Dakota is carp free. Lowhead dams on the Souris in Manitoba act as barriers to upstream fish migration except during periods of high flow. Historically high flow conditions occur during spring runoff, at which time the water temperature is approximately 35°-39°F. Carp spawning does not commence in earnest until temperatures reach a level of at least 62°F. By the time the Souris reaches 62°F, high flow conditions have subsided and the lowhead dams preclude upstream fish movement. This will no longer be the case when Burlington Dam is operational. Flows of 500 cfs at Minot, plus local inflow and perhaps Garrison Diversion Unit return flows, will be sufficient to enable carp to surmount existing barriers. Consequently, carp are expected to expand their range throughout the Souris River in North Dakota and into Saskatchewan.

The impact of carp establishment in upper reaches of the Souris River will have serious ecological effects. In feeding near the bottom, carp commonly roil the water, making it unfavorable for plant growth, fish and fish food organisms. This will only serve to degrade the existing sport fishery and, in general, the entire aquatic environment.

The result of carp introduction into Upper Souris and J. Clark Salyer Refuges will be a reduction in waterfowl production and use, as well as a change in management objectives in an attempt to control carp populations.

A detail[illegible] analysis of [illegible] effect[illegible]

[illegible] still [illegible]

[illegible] September 2[illegible], 19[illegible]

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For the more frequent floods, river bottom inundation periods will not change substantially from present conditions. There is generally no measurable reduction in waterfowl production or use-days. Riverine meadows and woodlands are recharged by flood irrigation. Clearing and snagging will reduce niche availability in the river habitats from Burlington to J. Clark Salyer Refuge. Lands above the 5,000 cfs flow contour will suffer some from the conversion of habitats to other uses. This reduces the value of habitats below the 5,000 cfs contour by reducing the interspersion value. The existing channel cutoffs plus the flow limits will encourage conversion of hardwoods to housing developments below Minot. It is estimated that an absolute loss of 180 acres of hardwoods will occur from Logan to Salyer Refuge from a minimum clearing and snagging project involving clearing back 10 feet from the edge of the channel on each side of the river.

For the intermediate floods, the following conditions are expected. Urbanization between Burlington and Logan causes harrassment to wildlife, reduces interspersion, and causes loss of habitat acreage. There will be conversion of meadowlands and woodlands to cropland in the Logan to Salyer segment. Clearing and snagging will reduce niche availability. Oxbows will be filled between Burlington and Minot to accommodate residential development. The remaining habitats will be reduced in value to wildlife because of stresses from urbanization. Cropland and woodland above Minot will be converted to residential developments. A late summer raise in flow rates is the opposite of existing natural drawdown conditions. Adverse impacts to aquatic plant crops and overall waterfowl and shorebird use are expected on J. Clark Salyer Refuge.

Conditions for the more infrequent floods are as follows. Summer flows near channel capacity increase the danger of flooding from local storm runoff causing disruption of waterfowl nesting in meadows. The hardwood forest above the 5,000 cfs flow contour will be deprived of needed flood irrigation and deteriorate. Direct conversion of the hardwoods to a cropland or grassland monotype will substantially alter the existing fauna of the river valley. More extensive impacts to aquatic flora on J. Clark Salyer Refuge are expected. There will be correspondingly larger reductions in waterfowl and shorebird use of the refuge.

The following table summarizes the net annualized terrestrial habitat unit changes and the area required for compensation of project losses.

Table 1. Burlington Dam Project - 200-Year Analysis

Habitat Type	Segment	Annualized HU Change	Area for Comp
Hardwood	1	-17868.4	609.2
Hardwood	2	-683.7	23.3
Hardwood	3	-6169.2	210.3
Hardwood	4	-5892.1	200.9
Hardwood	5	-6587.7	224.6
Hardwood	6	-125895.6	4292.4
Hardwood	7	-8380.7	285.7
Hardwood	Total	-171477.3	5846.5
Succession	1	5001.1	-76.6
Succession	2	195.0	-3.0
Succession	3	4875.5	-74.6
Succession	4	4918.8	-75.3
Succession	Total	14990.4	-229.5
Marsh	1	-9039.2	158.1
Marsh	2	-17562.8	307.2
Marsh	3	-4169.3	72.9
Marsh	4	-2365.0	41.4
Marsh	5	-1897.2	33.2
Marsh	Total	-35033.5	612.8
Marsh	6	-92570.4	1948.8
Marsh	Total	-92570.4	1948.8
Marsh	7	-103639.6	3272.5
Marsh	Total	-103639.6	3272.5
Grass	1	-9564.7	209.1
Grass	2	-15518.1	339.2
Grass	3	-12320.2	269.3
Grass	4	-20689.0	452.2
Grass	5	-10833.0	236.8
Grass	6	-32942.0	720.0
Grass	Total	-101867.0	2226.6
Grass	7	-5243.3	162.7
Grass	Total	-5243.3	162.7
Ag Land	1	-1314.5	20.1
Ag Land	2	-493.6	7.6
Ag Land	3	-2545.0	39.0
Ag Land	4	-2360.1	36.1
Ag Land	5	-12010.3	183.8
Ag Land	6	10163.0	-155.6
Ag Land	7	0.0	0.0
Ag Land	Total	-8560.5	131.0
GRAND TOTAL		-503401.2	13971.4

It may be seen in the above table that annualized habitat unit losses attributable to the project as now constituted amount to 503,401, and that the area required for compensation of habitat losses in kind is 13,971 acres. Of the 13,971 acres required for compensation, 2,766 acres are a result of project losses in Segments 1 through 4, while the remaining 11,205 acres stem from losses downstream from Burlington.

It is not valid to try to compare the habitat unit losses associated with the current plan with losses calculated for earlier project alternatives. This is the first detailed analysis of a plan involving a 4-foot raise of Lake Darling. Other new factors entering into this evaluation include: 1) new area capacity curves were used; 2) hydrographs for the existing condition 25- and 50-year floods were revised to reflect an adjustment of the 1969 flood; 3) maximum drawdown of Lake Darling prior to flood is 1594 instead of 1589; 4) concurrent drawdown of Lake Darling and Burlington pools to elevation 1598; 5) acreages of habitats were determined by 1-foot contour intervals instead of 5- and 10-foot intervals; and 6) duration of flooding for each flood event was determined for each 1-foot interval.

In view of the agreement to limit mitigation acreage to about 2,000 acres, we have developed a mitigation plan that involves the acquisition and restoration of 2,000 acres of drained wetland complexes in McHenry, Ward, Renville and Bottineau Counties. The purchase of drained wetland/upland complexes is a functional and biologically sound method of mitigating for Burlington habitat losses. There are several exceptional advantages to be gained from the purchase of drained complexes: 1) mitigation is achieved in that project losses are replaced by restoring other lost habitat rather than purchasing existing productive habitat; 2) drained wetland complexes have a very low existing biological value and a very high management potential, thus requiring a much smaller acreage to achieve compensation than existing productive habitat; 3) future wildlife management can be carried out in a setting removed from the vagaries of river flooding; 4) prairie wildlife is inextricably tied to wetland complexes and surrounding upland herbaceous cover; and 5) mitigating project losses by purchasing small scattered units, generally quarter sections, is likely to be easier on the local economy than taking a large block of land.

We are including as an attachment to this letter a list of drained wetland complexes in McHenry, Ward, Renville and Bottineau Counties. The list, compiled by our refuge staff, includes a total of 13,600 acres suitable for mitigation. The 2,000 acres can be selected from the list, which should provide flexibility as has been requested by Governor Link. In the event additional mitigation needs become necessary as new project features or changes in reservoir operation plans are evaluated, suitable areas will be readily available. Although the list includes 1,560 acres in Renville County, we recommend that no mitigation lands be acquired there because it receives no benefits from the project. In most cases, the drained wetland complexes are now in cropland. According to realty personnel in our Minot acquisition office, high value cropland in this area averages about $500 per acre. The project will assume the capital

improvement costs, estimated to be $100 per acre. These improvements would involve plugging ditches, reestablishing cover on the upland, surveying, posting, and fencing. After restoration of wetlands is accomplished, establishment and maintenance of adjacent upland herbaceous cover of various seral stages, density and height will be emphasized. Management of all portions of these integral parts will insure that each unit will achieve its maximum level of wildlife productivity.

In addition to the restoration of drained wetland complexes, we propose that a tree planting program be accomplished on project lands. Although land requirements for the project are not now known, we assume there will be a sufficient acreage of acquired project lands above the design Burlington pool elevation on which to plant a rather large acreage of trees. This would partially offset the loss of the bottomland hardwoods which will eventually occur when a large flood is stored in Burlington. We estimate that tree planting would cost about $240 per acre based on a cost of $5.50 per 100-foot row with 10-foot spacing. Annual operation, maintenance and replacement costs for the tree plantings, estimated to be $30 per acre for 7 years, would be an additional project expense.

A combination of the restoration of 2,000 acres of drained wetland complexes managed at optimum efficiency plus 1,000 acres of project lands planted to trees would produce a gain of 329,622 habitat units (207,500 wetland complexes and 122,032 tree plantings). This would amount to 65 percent of the habitat units lost to project construction and operation. In order to achieve this level of compensation, wetland complexes would have to be acquired at project year one and conversion to marsh and grass initiated immediately. Hardwoods would have to be planted at year one and managed at an optimum level to obtain maximum values. Delays in the acquisition of lands, conversion to marsh and grass, and planting trees would reduce the habitat unit replacements listed above. Total capital cost of implementing this plan is estimated to be $1,440,000, of which $1,200,000 is required for the wetland complexes and $240,000 for tree planting. Operation, maintenance and replacement costs of $30,000 per year for 7 years would be required for the tree plantings.

Legislation has been passed by the North Dakota Legislature that could, according to some interpretations, limit or eliminate the ability of the North Dakota Game and Fish Department to manage project lands or even lands acquired specifically for mitigation. In view of the potential effects of this legislation and the preliminary nature of your plans for land acquisition, no commitment will be made at this time regarding a managing agency for project wildlife management lands. You can be assured that either the North Dakota Game and Fish Department or the Fish and Wildlife Service will manage restored wetland complexes and any project lands that may be planted to trees. The suitability for wildlife management of other project lands that may be acquired in fee title above or below Upper Souris Refuge will be

determined when their location is known. It is logical to assume that project lands acquired immediately adjacent to Upper Souris Refuge should be incorporated into the refuge. Operation and maintenance funds will be required for any lands that the Game and Fish Department may ultimately manage, whether they be restored wetland complexes, tree plantings, or other project lands.

In order to assure protection of Upper Souris and J. Clark Salyer National Refuges and to offset project induced damages to terrestrial wildlife habitat, it is recommended that:

1. Dams, dikes and water control structures of Upper Souris and J. Clark Salyer National Wildlife Refuges be modified and reinforced at project expense to prevent damage by flooding and to permit them to continue to operate during the extended high releases from Lake Darling and Burlington Dams. Major cost items include complete replacement of Dams 96, 87 and 41 ($1,779,047); raise dikes, strengthen, and replace control structures of Dams 320, 326, 332, 341 and 357 ($2,136,775); and a contingency fund to finance minor repairs of Dams 83, 96, 87 and 41 following inundation and for cleanup of debris and sediment ($152,976).

2. Upper Souris Refuge headquarters be replaced above the Burlington maximum pool elevation. The cost to the project is estimated to be $500,000.

3. Project plans provide the necessary degree of assurance that water rights of the Fish and Wildlife Service will be safeguarded. These rights include the seasonal use of 7,044 acre-feet and a storage right of 112,000 acre-feet at Upper Souris Refuge and a seasonal right for 53,634 acre-feet and a storage right of 8,300 acre-feet at J. Clark Salyer Refuge.

4. Approximately 2,000 acres of drained wetland complexes be acquired in fee title and developed at project expense at the same time as other project lands and be turned over to the managing agency for immediate restoration. The cost of acquisition is estimated to be $1,000,000. Development costs are expected to be $200,000.

5. One thousand acres of trees be established on project lands not subject to flooding at an estimated project cost of $240,000. Operation, maintenance and replacement costs of $30,000 would be required for 7 years.

6. A general plan be formulated pursuant to the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661, et seq.) for management of appropriate project lands and waters for wildlife conservation purposes.

7. Additional detailed studies of fish and wildlife resources be conducted for those project features not yet evaluated and for any substantial departures from the current recommended plan. Any lessening

of the reservoir release rates would represent a major additional adverse impact that would require us to either recommend a greatly expanded mitigation plan or to oppose the project. Impacts of the project on aquatic habitat require more study. If carp are introduced into the Souris River in North Dakota as a result of the project, control measures will have to be undertaken at project expense.

We hope the material in this letter will satisfy your needs for information relative to the wildlife mitigation plan. Our staff, in cooperation with the North Dakota Game and Fish Department, can work together to select the 2,000 acres of drained wetland complexes from the attached list.

It is requested that we be advised as soon as possible concerning the actions you propose to take on each of our recommendations.

Sincerely yours,

Wm Aultfather

Wm. Aultfather
Area Manager

Attachments (2)

Attachment (1)

Burlington Dam Mitigation Acres

McHenry County

Township	Range	Section	Acres
159	80	NE 23	160
159	80	SE 20	160
159	80	SE 21	160
159	80	SW 21	160
159	80	NE 21	160
159	80	NW 20	160
159	80	NE 29	160
158	80	SW 15	160
153	78	SE 23	160
153	78	NE 27	160
153	78	SE 22	160
159	80	NW 34	160
159	79	SE 31	160
158	80	S 1/2 22	320
158	80	E 1/2 6	320
158	79	NW 19	160
159	80	SE 9	160
		TOTAL	3,040

Burlington Dam Mitigation Acres

Ward County

Township	Range	Section	Acres
154	82	SW 19	160
154	82	NW 30	160
154	83	SE 24	160
154	83	E 1/2 25	320
156	87	22	640
156	87	23	640
156	87	26	640
160	89	SW 8	160
160	89	SE 8	160
[illegible]	[illegible]	[illegible]	640
160	89	NW 17	160
		TOTAL	3,840

Burlington Dam Mitigation Acres

Renville County

Township	Range	Section	Acres
161	84	NE 4	160
160	84	NE 26	160
159	84	NW 18	160
162	85	NW 26	160
160	84	SE 34	160
161	85	SW 3 and NE SE 4	200
158	81	NW 20	160
158	83	NE 23	160
160	84	W 1/2 NW 25	80
158	86	SW 9	160
		TOTAL	1,560

Burlington Dam Mitigation Acres

Bottineau County

Township	Range	Section	Acres
161	77	W 1/2 36	320
161	77	SW 15	160
162	78	E 1/2 SE 5	80
162	78	N 1/2 5	320
160	79	NE 8	160
160	80	NE 12	160
161	81	W 1/2 5	320
159	82	NE 1	160
160	80	NE 17	160
162	81	SE 13	160
162	81	SE 16	160
160	82	SE 26	160
160	82	S 1/2 NE 26	80
160	83	S 1/2 NW 10	80
160	83	N 1/2 SW 10	80
160	83	NW SE 10	40
159	83	E 1/2 11	320
159	82	SE 3	160
162	82	SW 16	160
162	82	SE 17	160
161	82	NE 17	160

(Continued)

Bottineau County (Continued)

Township	Range	Section		Acres
161	82	SE 8		160
159	83	SW 12		160
159	82	SE 29		160
162	82	SW 14		160
162	82	NE 23		160
161	83	W 1/2 20		320
161	82	NE 30		160
160	83	N 1/2 30		320
			TOTAL	5,160

Attachment (2)

Distribution List

District Engineer (5)
St. Paul District, Corps of Engineer
1210 U.S. Post Office & Custom House
St. Paul, MN 55101

Regional Director (2)
U.S. Fish & Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

National Park Service (1)
Rocky Mountain Region
655 Parfet Street
P.O. Box 25287
Denver, CO 80225

Bureau of Outdoor Recreation (1)
Mid-Continent Region
Box 25387
Denver Federal Center
Denver, CO 80225

Upper Souris National Wildlife Pefuge (1)
R.R. 1
Foxholm, ND 58738

J. Clark Salyer National Wildlife Refuge (1)
Upham, ND 58789

Commissioner (1)
North Dakota Game & Fish Department
2121 Lovett Avenue
P.O. Box 1229
Bismarck, ND 58501

U.S. Environment Protection Agency (1)
1860 Lincoln Street
Denver, CO 80203

Honorable Milton R. Young (1)
United States Senate
Washington, D.C. 20510

Honorable Quentin N. Burdick (1)
United States Senate
Washington, D.C. 20510

Honorable Mark Andrews (1)
House of Representatives
Washington, D.C. 20515

Honorable Arthur A. Link, Governor (1)
State Capitol
Bismarck, ND 58501

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Area Office - North Dakota
1500 Capitol Avenue
P. O. Box 1897
Bismarck, North Dakota 58501

SEP 8 1977

Colonel Forrest T. Gay, III
District Engineer, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Mr. Harvey Willoughby has asked me to reply to your letter of August 5, 1977, which identified issues the Fish and Wildlife Service considered unresolved concerning the Burlington Dam project, suggested plans to resolve them, and sought our concurrence in the plans.

Listed below are the unresolved issues, followed first by your discussion, and then by my response to each point.

(a) "Only 65 percent of the necessary mitigation lands will be provided by the acquisition of 2,000 acres of drained wetlands and the planting of 1,000 acres of trees on project lands."

(CE) "Even though the analysis shows what appears to be only 65 percent of the necessary mitigation lands, based on our earlier agreement, it was my understanding that your request for lands would not exceed 2,000 acres. The provision of planting 1,000 acres of trees on project lands is a new feature but appears to be reasonable. However, due to a more recent real estate acquisition proposal to purchase only those lands up to an elevation of the 100-year storage in the reservoir rather than to 1620, there may not be 1,000 acres of unforested land available outside the reservoir."

(FWS) The fact that the restoration of 2,000 acres of drained wetland complexes and the forestation of 1,000 acres of project lands will only compensate for 65 percent of the terrestrial habitat units lost to project construction and operation is not an issue that requires resolution in our view. The 65 percent figure was derived from a comparison of habitat unit gains that would accrue to the wetland restoration and tree planting features of the project with habitat unit losses attributable to the project. We recognize that there are other benefits from the project

Exhibit 4

that are unmeasurable in terms of habitat units. These are the values that would result from the raising and upgrading of Lake Darling Dam and the upgrading of dams, dikes, and water control structures of Upper Souris and J. Clark Salyer Refuges. You may rest assured that the Fish and Wildlife Service will request no more mitigation lands if the Burlington project is implemented as now planned.

During a September 6, 1977, meeting with members of your staff, real estate maps were reviewed. Your technicians concluded that they are confident there will be sufficient lands available in uneconomic remnants on which to plant about 1,000 acres of trees, even if fee title is acquired only up to the 100-year reservoir storage. Consequently, this is not an issue.

(b) "Mitigation needs have not been calculated for the losses from the construction and operation of the Des Lacs Diversion Dam and Tunnel nor from the levees downstream of Burlington."

(CE) "It was my understanding from our previous discussions that the adverse environmental impacts of the tunnel and levees would be negligible and that mitigation for these features would not be necessary."

(FWS) Previously, we have not had the opportunity to review plans for the Des Lacs Diversion Dam and Tunnel or for levees downstream from Burlington. However, during the visit to your office on September 6, 1977, members of my staff were shown aerial photographs and details of the Des Lacs Diversion. They concluded that habitat losses would be minimal and that no additional mitigation would be required. Without specifically examining detailed plans for levees downstream from Burlington, we conclude that losses from this aspect of the project would also be minimal and would require no additional mitigation. We will work closely with your staff during advanced design planning to assure that everything possible is done to keep adverse impacts to a minimum.

(c) "Mitigation needs for aquatic losses have not been calculated."

(CE) "It is my understanding that your staff viewed losses to the aquatic environment negligible in comparison to terrestrial losses and that mitigation for aquatic losses would not be necessary."

(FWS) Although aquatic habitat losses are undoubtedly much smaller than terrestrial habitat losses, we do not consider them negligible. The problem is that there is presently no satisfactory method to quantify aquatic habitat losses in terms of habitat units as we did for terrestrial habitat. We propose that impacts of the project on aquatic habitat be further investigated during the project advanced design phase so that impacts can be more precisely defined. We believe ways can be

found through structural and operational modifications to offset some of the adverse effects of the project on aquatic habitat. In any event, no additional lands will be required for this purpose.

(d) "Further research is necessary to determine why the Souris River in North Dakota is carp free; and, if operation of Burlington Dam would permit migration of carp from Manitoba to North Dakota, facilities for carp control should be included in the mitigation plan."

(CE) "Our current cost estimates will include preliminary costs for carp control measures. The problem will be further investigated during the project design phase."

(FWS) We are pleased that you have included preliminary costs for carp control measures in your estimates and we concur with your plan to further investigate the problem during the project design phase. Our engineers and biologists will work very closely with your staff to insure that the Souris River in North Dakota remains free of carp.

(e) "Losses from snagging and clearing below Minot must be mitigated."

(CE) "Snagging and clearing work has been deleted from the plan."

(FWS) Since snagging and clearing has been deleted from the plan, this former feature of the project is no longer an issue to be solved.

(f) "Losses from construction and operation of the Gassman Coulee Dam must be mitigated."

(CE) "Although considered, a dam on Gassman Coulee is not included in the plan."

(FWS) This being the case, mitigation for a dam on Gassman Coulee is not an issue.

In conclusion, I no longer consider any major issues concerning the Burlington Dam project to be unresolved from the standpoint of the U.S. Fish and Wildlife Service. Although some details (see items c and d) remain to be worked out during the project advanced design phase, this is to be expected in any project, and I see no reason why they should present any obstacles to a successful completion of the project. I look forward to working closely with you and your staff during the remaining phases of the project.

Sincerely yours,

Wm Aultfather

Wm. Aultfather
Area Manager

cc: Regional Director, Denver (AENV)

United States Department of the Interior

FISH AND WILDLIFE SERVICE

[illegible]

FA

Brigadier General Robert [illegible]
Division Engineer
North Central Division
U.S. Army Corps of Engineers
536 South Clark Street
Chicago, Illinois 60605

Dear General Moore:

North Dakota newspaper articles brought [illegible] the project [illegible] apparent misunderstanding on the part of some cit[illegible] to the Burlington [illegible] project.

The U.S. Fish and Wildlife Service [illegible] Corps of Engineers, in its acquisition of the 2,[illegible] lands, buy the land when possible [illegible]. We are hopeful the Corps of Engineers will have little trouble [illegible] mitigation [illegible] for the Burlington project.

Further, the Fish and Wildlife Service recommends that [illegible] Corps of Engineers seek to acquire the 2,000 acres for mitigation first from property owners of the Souris Basin. If, after a reasonable [illegible], sufficient Souris Basin residents have not indicated a willin[illegible] sell [illegible] fair market value, we recommend that the effort be extended [illegible] suitable [illegible] gation lands located elsewhere.

Your assistance in clearing up some [illegible] project will be appreciated.

First, the maximum acreage of suitable habitat [illegible] mitigation lands for the project is only 2,000 [illegible] expressed concern that the acreage [illegible] for their concern.

CONSERVE AMERICA'S ENERGY

Exhibit 5

Save Energy and You Serve America!

Second, the tracts in the Souris Basin that we have identified as suitable for wildlife mitigation are of the type we could use in maintenance of wildlife habitat, and from which you could acquire the [illegible] acres of mitigation lands. However, those identified are not the only suitable lands acceptable for mitigation. The Service stands ready to assist the Corps in identification of other suitable lands in the event the [illegible] acres cannot be satisfied from among the lands already identified.

The U.S. Fish and Wildlife Service neither supports nor opposes the Burlington Dam project. The Congress requires, however, that when wildlife habitat is lost because of a Federal project, the Service must identify suitable mitigation lands to compensate for those losses.

In my experience, the people of North Dakota are extremely fair in making judgments when they are provided with the facts. I am providing copies of this letter to a number of news media outlets in North Dakota in hope they will assist in getting these facts to the public.

Sincerely,

Harvey Willoughby

Regional Director

NORTH DAKOTA GAME AND FISH DEPARTMENT

BISMARCK, N.D.
58501

April 12, 1977

Mr. William Aultfather
Area Manager
U.S. Fish and Wildlife Service
P.O. Box 1897
Bismarck, North Dakota 58501

Dear Bill:

We have reviewed your draft planning aid letter to the Corps concerning impacts of the Burlington project on fish and wildlife resources and recommendations for mitigating those impacts. We believe the impacts have been adequately identified and concur with the proposed habitat mitigation plan.

The only suggestion we have is that the report should make mention of two additional items: 1) operation and maintenance funds be provided to the managing agency for tree cultivation, etc., and 2) the cost of fencing the mitigation sites should rest with the Corps.

The only other comment we have is that the mitigation plan should remain as flexible as possible, both as it relates to the wetland tracts and the tree plantings.

We appreciate having the opportunity to review this report.

Sincerely yours,

Russell W. Stuart
Commissioner

RS/dh

Exhibit 6